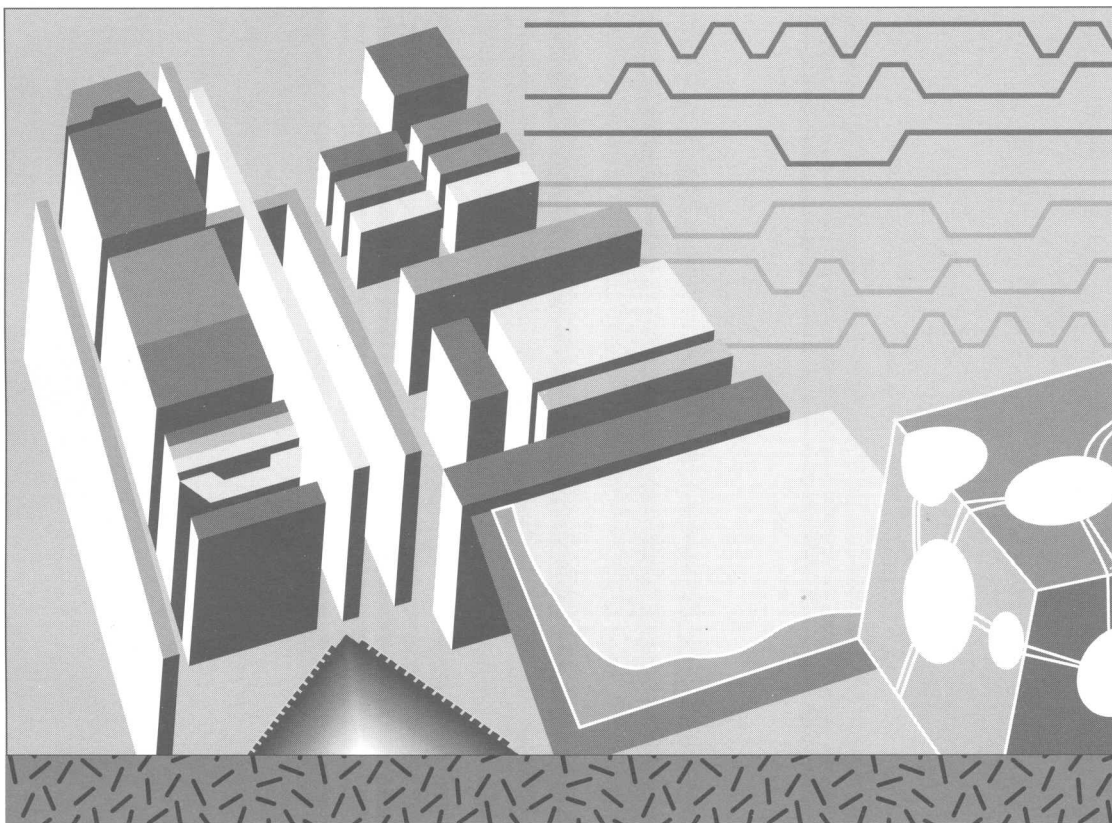


K Series®

Selection
Guide



78K Series

8-/16-Bit Single-Chip Microcomputer

March 1995

NEC

<p>The export of these products may be prohibited without government approval. To export or re-export from Japan may also be prohibited without a license from the Japanese government.</p>	<p>The export of these products may be prohibited without government approval. To export or re-export from Japan may also be prohibited without a license from the Japanese government.</p>	<p>The export of these products may be prohibited without government approval. To export or re-export from Japan may also be prohibited without a license from the Japanese government.</p>
<p>Note that this product can not be used for the IC card (SMART CARD).</p>	<p>The IC card (SMART CARD) is not used for the IC card (SMART CARD).</p>	<p>The IC card (SMART CARD) is not used for the IC card (SMART CARD).</p>
<p>Caution: The IC card (SMART CARD) is not used for the IC card (SMART CARD).</p>	<p>Caution: The IC card (SMART CARD) is not used for the IC card (SMART CARD).</p>	<p>Caution: The IC card (SMART CARD) is not used for the IC card (SMART CARD).</p>
<p>The application of this product is not intended for use in...</p>	<p>The application of this product is not intended for use in...</p>	<p>The application of this product is not intended for use in...</p>
<p>The information in this document is based on documents issued in XXXX. The information is subject to change without notice. For the actual design, refer to the latest publications of data sheets. No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors or omissions in this document. NEC Corporation does not assume any liability for infringement of patents, trademarks, or other intellectual property rights of third parties by or arising from use of a device described herein. The license, either express, implied or otherwise, granted herein does not constitute an offer of sale. While NEC Corporation has been making continuous effort to enhance the reliability of its products, it cannot be eliminated entirely. To minimize risk of failure, it is recommended that users of NEC semiconductor devices should take appropriate sufficient safety measures in its design, such as redundancy, the commitment, and failure analysis. NEC devices are classified into the following three quality grades: "Standard", "Special", and "Super". The "Standard" quality grade applies only to general-purpose applications. The "Special" quality grade applies to applications requiring higher reliability. The "Super" quality grade applies to applications requiring the highest reliability. Customers must specify the quality grade of each device when ordering. Standard equipment, office equipment, communications equipment, test equipment, and various equipment, home electronic appliances, medical equipment, and industrial robots. Special equipment (automobiles, trains, ships, etc.), traffic, and disaster relief systems, safety equipment and medical equipment, and not specifically designed for a support. Special equipment (automobiles, trains, ships, etc.), traffic, and disaster relief systems, safety equipment and medical equipment, and not specifically designed for a support.</p>	<p>The information in this document is based on documents issued in XXXX. The information is subject to change without notice. For the actual design, refer to the latest publications of data sheets. No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors or omissions in this document. NEC Corporation does not assume any liability for infringement of patents, trademarks, or other intellectual property rights of third parties by or arising from use of a device described herein. The license, either express, implied or otherwise, granted herein does not constitute an offer of sale. While NEC Corporation has been making continuous effort to enhance the reliability of its products, it cannot be eliminated entirely. To minimize risk of failure, it is recommended that users of NEC semiconductor devices should take appropriate sufficient safety measures in its design, such as redundancy, the commitment, and failure analysis. NEC devices are classified into the following three quality grades: "Standard", "Special", and "Super". The "Standard" quality grade applies only to general-purpose applications. The "Special" quality grade applies to applications requiring higher reliability. The "Super" quality grade applies to applications requiring the highest reliability. Customers must specify the quality grade of each device when ordering. Standard equipment, office equipment, communications equipment, test equipment, and various equipment, home electronic appliances, medical equipment, and industrial robots. Special equipment (automobiles, trains, ships, etc.), traffic, and disaster relief systems, safety equipment and medical equipment, and not specifically designed for a support. Special equipment (automobiles, trains, ships, etc.), traffic, and disaster relief systems, safety equipment and medical equipment, and not specifically designed for a support.</p>	<p>The information in this document is based on documents issued in XXXX. The information is subject to change without notice. For the actual design, refer to the latest publications of data sheets. No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors or omissions in this document. NEC Corporation does not assume any liability for infringement of patents, trademarks, or other intellectual property rights of third parties by or arising from use of a device described herein. The license, either express, implied or otherwise, granted herein does not constitute an offer of sale. While NEC Corporation has been making continuous effort to enhance the reliability of its products, it cannot be eliminated entirely. To minimize risk of failure, it is recommended that users of NEC semiconductor devices should take appropriate sufficient safety measures in its design, such as redundancy, the commitment, and failure analysis. NEC devices are classified into the following three quality grades: "Standard", "Special", and "Super". The "Standard" quality grade applies only to general-purpose applications. The "Special" quality grade applies to applications requiring higher reliability. The "Super" quality grade applies to applications requiring the highest reliability. Customers must specify the quality grade of each device when ordering. Standard equipment, office equipment, communications equipment, test equipment, and various equipment, home electronic appliances, medical equipment, and industrial robots. Special equipment (automobiles, trains, ships, etc.), traffic, and disaster relief systems, safety equipment and medical equipment, and not specifically designed for a support. Special equipment (automobiles, trains, ships, etc.), traffic, and disaster relief systems, safety equipment and medical equipment, and not specifically designed for a support.</p>
<p>TRON is an abbreviation of The Real-time Operating system Nucleus. ITRON is an abbreviation of Industrial TRON. FIP is a trademark of NEC Corporation. EEPROM, IEBus, Inter Equipment Bus, and QTOP are trademarks of NEC Corporation. MS-DOS is a trademark of Microsoft Corporation. PC/AT and PC DOS are trademarks of IBM Corporation.</p>	<p>TRON is an abbreviation of The Real-time Operating system Nucleus. ITRON is an abbreviation of Industrial TRON. FIP is a trademark of NEC Corporation. EEPROM, IEBus, Inter Equipment Bus, and QTOP are trademarks of NEC Corporation. MS-DOS is a trademark of Microsoft Corporation. PC/AT and PC DOS are trademarks of IBM Corporation.</p>	<p>TRON is an abbreviation of The Real-time Operating system Nucleus. ITRON is an abbreviation of Industrial TRON. FIP is a trademark of NEC Corporation. EEPROM, IEBus, Inter Equipment Bus, and QTOP are trademarks of NEC Corporation. MS-DOS is a trademark of Microsoft Corporation. PC/AT and PC DOS are trademarks of IBM Corporation.</p>

The export of these products from Japan is regulated by the Japanese government. The export of some or all of these products may be prohibited without governmental license. To export or re-export some or all of these products from a country other than Japan may also be prohibited without a license from that country. Please call an NEC sales representative.

The μ PD78244 is manufactured and sold in accordance with the license agreement with BULL CP 8 pertinent to the patent of microcomputers with on-chip EEPROM.

Note that this product can not be used for the IC card (SMART CARD).

Caution: The I²C bus interface circuit is incorporated in the μ PD78002Y, 78014Y, 78024Y, 78044AY, 78054Y, 78064Y and 78078Y subseries.

Those who use the I²C bus interface can be granted the license below by giving prior notification before ordering the custom code.

Purchase of NEC I²C components conveys a license under the Philips I²C Patent Rights to use these components in an I²C system, provided that the system conforms to the I²C Standard Specification as defined by Philips.

The application circuits and their parameters are for references only and are not intended for use in actual design-in's.

The information in this document is based on documents issued in XXXXXX, 19XX at the latest. The information is subject to change without notice. For the actual design-in refer to the latest publications of data sheet, etc. for the most up-date specifications of the device.

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customer must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices in "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact NEC Sales Representative in advance.

Anti-radioactive design is not implemented in this product.

SUMMARY CONTENTS

<u>1. 78K SERIES FEATURES</u>	<u>1</u>
<u>2. 78K SERIES PRODUCT DEVELOPMENT</u>	<u>3</u>
<u>3. 78K SERIES APPLICATION FIELDS</u>	<u>5</u>
<u>4. 78K SERIES PRODUCTS</u>	<u>25</u>
<u>5. DEVELOPMENT TOOLS AND EVALUATION TOOLS</u>	<u>119</u>
<u>6. THIRD-PARTY TOOL SUPPORT LIST</u>	<u>150</u>
<u>7. 78K SERIES-RELATED DOCUMENTS</u>	<u>161</u>

CONTENTS

1.	78K SERIES FEATURES	1
2.	78K SERIES PRODUCT DEVELOPMENT	3
3.	78K SERIES APPLICATION FIELDS	5
3.1	Application System Examples	7
3.1.1	Compact disk player (mass-produced model)	7
3.1.2	VCR (system component)	8
3.1.3	Microwave oven	9
3.1.4	VCR timer	9
3.1.5	Portable CD player	10
3.1.6	Car-mounted audio system (tuner/deck)	10
3.1.7	Cordless telephone base unit	11
3.1.8	Air conditioner	11
3.1.9	Deck type VCR	12
3.1.10	Handy video camcorder	13
3.1.11	Printer	14
3.1.12	Electronic typewriter	15
3.1.13	Laser beam printer (LBP) engine	16
3.1.14	PPC	17
3.1.15	Autofocus single-lens reflex camera	18
3.1.16	Stepping motor control	19
3.1.17	Antiskid control	20
3.1.18	Inverter air conditioner exterior unit control	21
3.1.19	Engine control	22
3.1.20	Hard disk servo control system	23
3.1.21	General purpose servo controller	24
4.	78K SERIES PRODUCTS	25
4.1	Individual Series Features	25
4.2	Function Lists	27
4.3	78K/0 Series	53
4.3.1	μ PD78002	55
4.3.2	μ PD78014	57
4.3.3	μ PD78024	59
4.3.4	μ PD78044A	61
4.3.5	μ PD78054	63
4.3.6	μ PD78078	65
4.3.7	μ PD78064	67
4.3.8	μ PD78083	69
4.3.9	μ PD78098	71
4.3.10	μ PD78002Y	73

4.3.11	μ PD78014Y	75
4.3.12	μ PD78054Y	77
4.4	78K/I Series	79
4.4.1	μ PD78138	81
4.4.2	μ PD78148	83
4.5	78K/II Series	85
4.5.1	μ PD78214	87
4.5.2	μ PD78218A	89
4.5.3	μ PD78224	91
4.5.4	μ PD78234	93
4.5.5	μ PD78244	95
4.6	78K/III Series	97
4.6.1	μ PD78312A	99
4.6.2	μ PD78322	101
4.6.3	μ PD78328	103
4.6.4	μ PD78334	105
4.6.5	μ PD78352A	107
4.6.6	μ PD78356	109
4.6.7	μ PD78366	111
4.6.8	μ PD78372	113
4.7	78K/IV Series	115
4.7.1	μ PD784026	117
5.	DEVELOPMENT TOOLS AND EVALUATION TOOLS	119
5.1	Development Tools	119
5.2	Evaluation Tools	122
5.3	Software for Integration	123
5.4	List of Tools	124
5.4.1	List of development tools and evaluation tools	124
5.4.2	List of software tools	132
5.5	Development Tool System Upgrading	141
5.6	List of PROM Programmer Adapters	147
6.	THIRD-PARTY TOOL SUPPORT LIST	150
6.1	Development Tools by Third Parties	150
6.2	PROM Programmer Made by Third Party	154
7.	78K SERIES-RELATED DOCUMENTS	161
7.1	Documents List	161
7.2	Tool Documents List	168

PREFACE

NEC was first to develop a 4-bit microcomputer in 1973 in Japan. Since then we have continuously developed leading-edge technology and various 4-bit microcomputers including the μ PD7500 series and the 75X series as well as 8-bit microcomputers such as the 87AD series. These products enjoy great popularity among our customers.

The 78K series has been developed based on the technical know-how acquired for the above products and customers' comments were considered to improve high performance and develop new application fields for various kinds of equipment ranging from audio equipment, VCRs, air conditioners, and microwave ovens to office machinery such as copy machine and facsimiles, industrial machinery, and automotive electronic equipment. For this purpose, 8-bit/16-bit microcomputer architecture was developed to enable high-speed control operation.

This Selection Guide presents 78K series application fields, the features of each product, their development environment, and so forth, to enable you to select from the 78K series the product best suited to your needs.

1. 78K SERIES FEATURES

The 78K series comprises 8-bit/16-bit microcomputer products. This series is divided into 5 series consisting of 78K/0, 78K/I, 78K/II, 78K/III, and 78K/IV. The 78K series has the features shown below.

- <1> CPU with flexible architecture compatible with single-chip/multi-chip configuration
Can access high-speed internal memory and large-capacity external memory.
- <2> Internal functions with improved manipulability
 - (1) Internal RAM in which high-speed short direct addressing can be used
 - (2) On-chip peripheral hardware which can be manipulated by the special function register (SFR) in the same way as a register
 - (3) Various bit manipulation instructions and Boolean operation instructions
- <3> Instruction sets with high compatibility
 - (1) General register function assignment with a high degree of compatibility among products
 - (2) Common mnemonics compliant with standards of IEEE (Institute of Electrical and Electronics Engineers, Inc.)
 - (3) Highly expandable addressing common to the entire series
- <4> Advanced real-time processing
 - (1) General registers of bank configuration capable of efficient accessing
 - (2) Interrupt control function by which the processing best suited to multiple interrupt is programmable.
 - (3) Macro service function which is an NEC's original product highly and internationally evaluated (excluding 78K/0).
 - (4) Context switching function by which information necessary for return from interrupt can be quickly saved (78K/III and 78K/IV).

2. 78K SERIES PRODUCT DEVELOPMENT

The 78K series comprises a range of 8-bit and 16-bit single-chip microcomputers. This series is made up of 5 series shown in Figure 2-1 to provide an appropriate model for any of the continually expanding range of application fields for single-chip microcomputers.

Figure 2-1. 78K Series Configuration

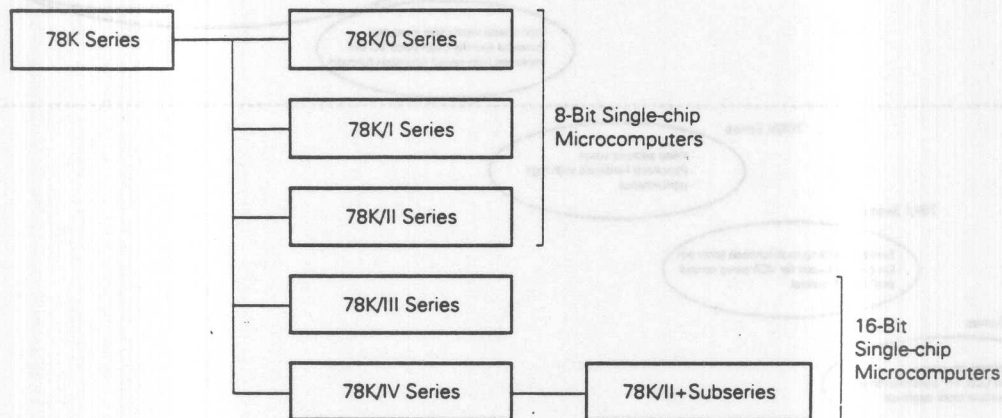
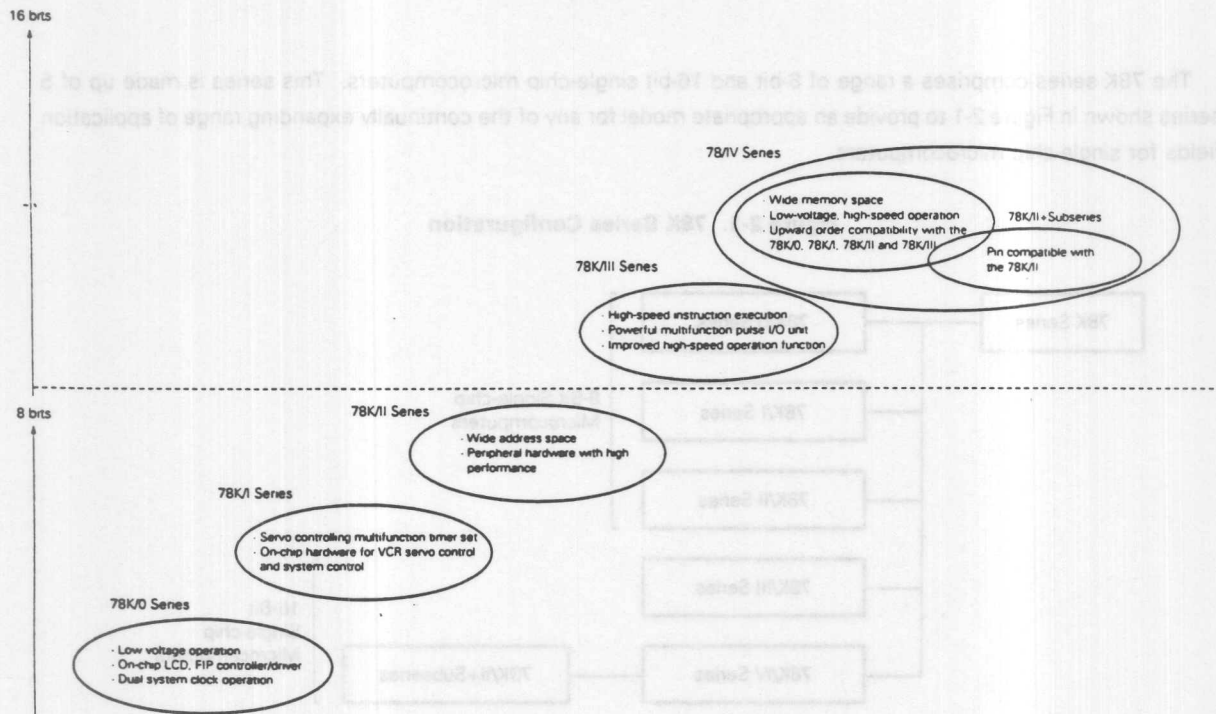


Figure 2-2. 78K Series Product Development



3. 78K SERIES APPLICATION FIELDS

The 78K series consists of the following 5 series. The 78K series has a characteristic function and instruction set suited to the application fields shown in Table 3-1. Therefore, the microcomputer best suited can be selected in a wide range of application fields.

(1) 78K/0 series

This series with a wide range of operating supply voltage and low current dissipation is suitable for battery driven portable set, etc.

(2) 78K/I series

This series with three sets of high-speed timers is suitable for VCRs or digital audio tape recorders necessary for multiple high-precision servo controls.

(3) 78K/II series

This series, with a wide 1M-byte address space and external memory support function, is suitable for a printer, facsimile, floppy disk drive, or plain paper copier which processes large capacity of data.

(4) 78K/III series

In this series, 16-bit architecture is adopted and this series has various instructions and higher operation than 78K/II, and is suitable for FA equipment and automotive electronic equipment which require high-speed real-time control.

(5) 78K/IV series

This series has the 1MB program memory space and 16MB data memory space, and provides the upward order compatibility with the 78K/0, 78K/I, 78K/II and 78K/III. In addition to the enhanced instruction set, high-speed and low-voltage operation can be performed.

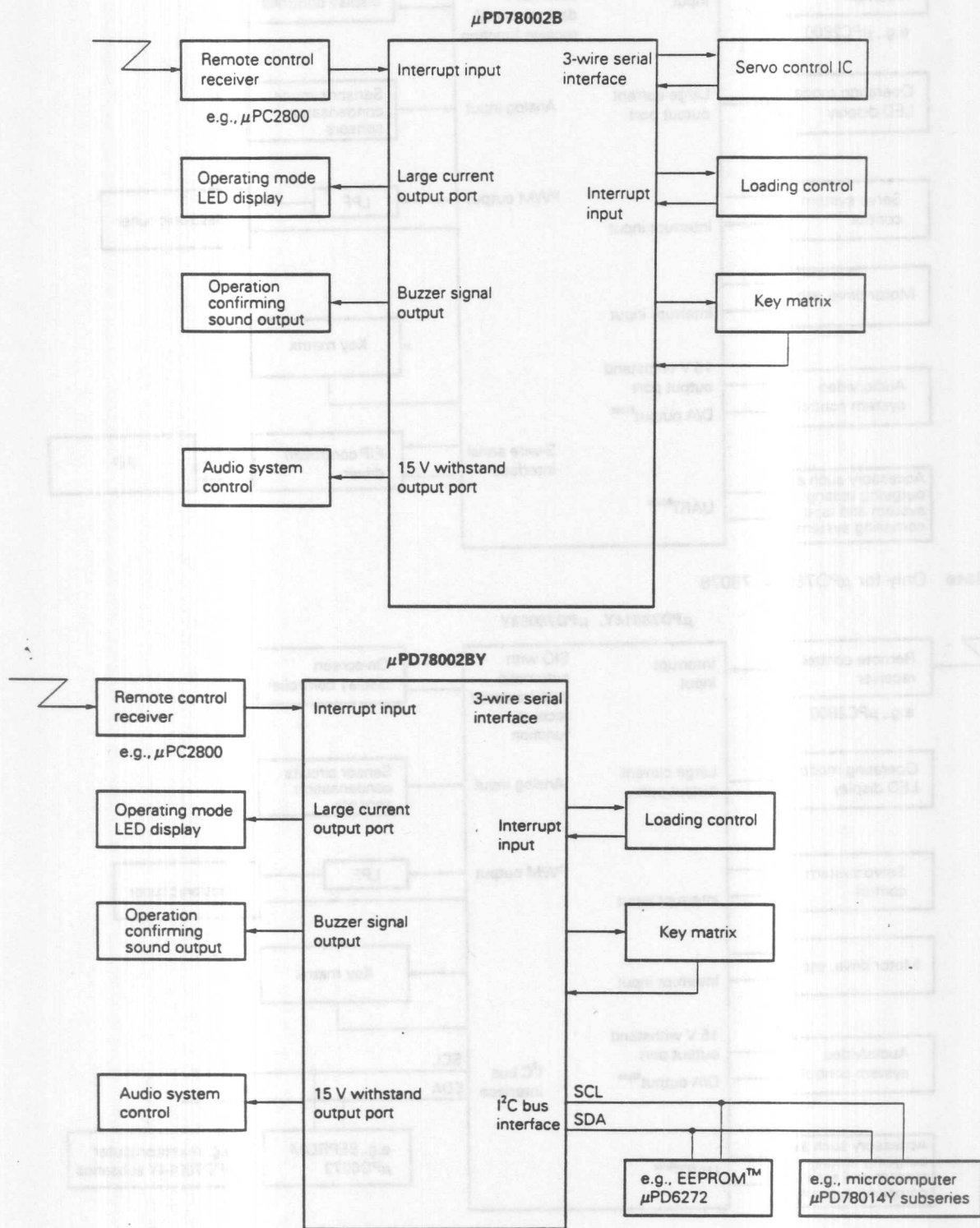
The 78K/IV series contains the 78K/II+ subseries which is pin-to-pin compatible to the 78K/II series. 78K/II+ subseries is a host-compatible product of the 78K/II series and suitable for the PPC, LBP, and autofocus camera that need high-speed processing of analog data.

Table 3-1. Examples of 78K Series Applications

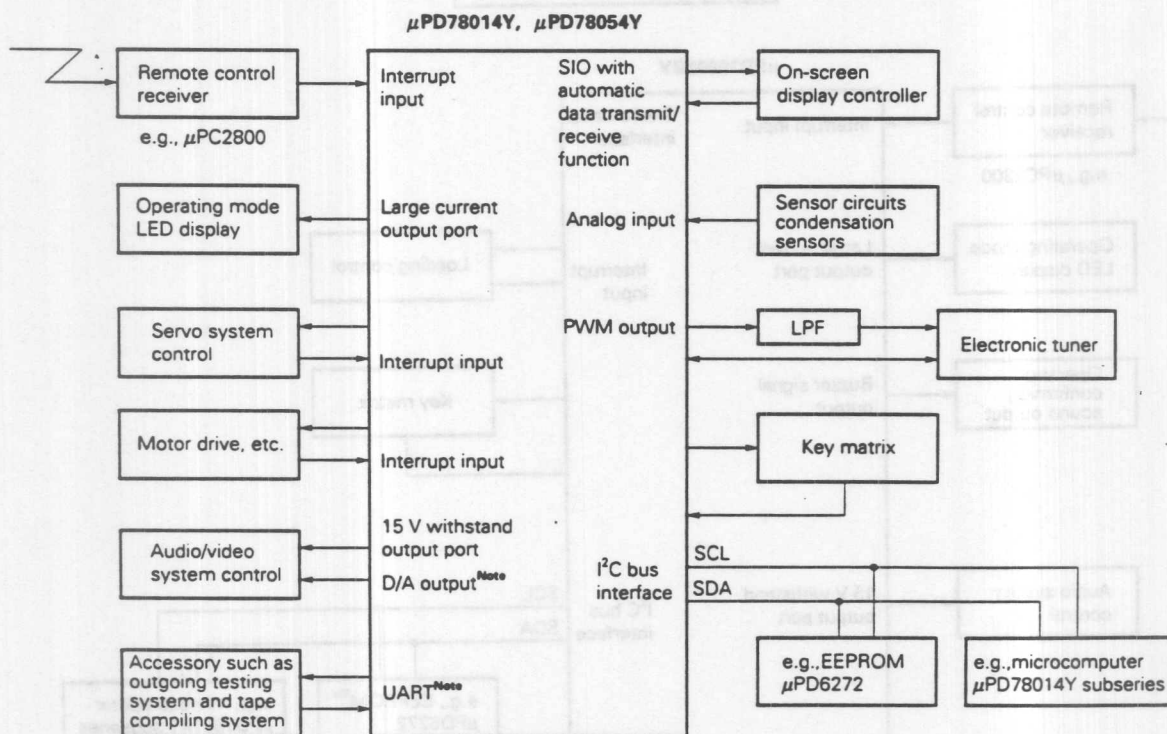
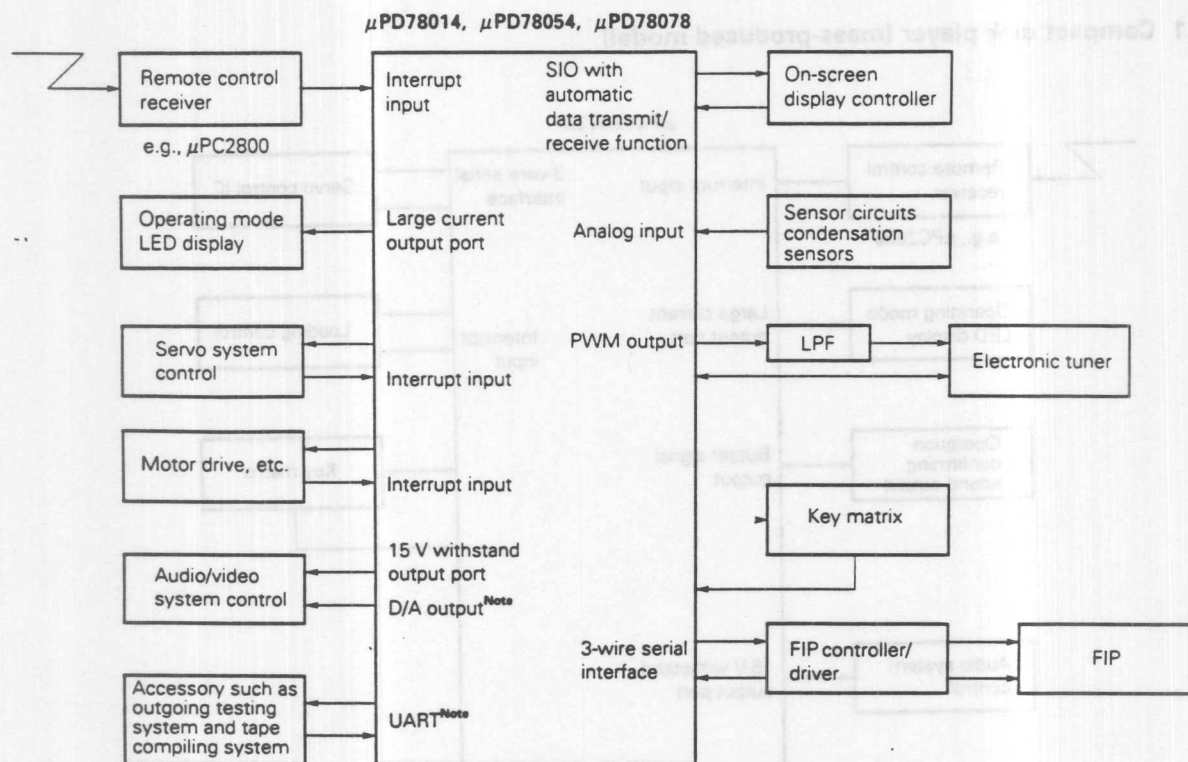
Application Field		78K/0	78K/I	78K/II	78K/III	78K/IV (78K/II+)
Video and audio equipment	Deck-type VCRs	○	○			
	Handy video camcorder	○	○	○	○	○
	Mini-stereo component	○				
	DAT (Digital audio tape recorder)	○	○	○		
	LDP (Laser disk player)	○	○	○		
	Car-mounted audio	○		○		
Telephone	Telephone	○				○
Still camera	Compact camera	○				
	Autofocus camera	○		○	○	○
	Electronic still camera		○		○	
Home electronics appliance	Inverter air conditioners			○	○	○
	Water heater	○		○		○
	Electronic musical instruments	○		○	○	○
OA equipment	Printer	○		○	○	○
	LBP (Laser beam printer)	○		○	○	○
	Typewriter	○		○		○
	PPC (Plain paper copier)			○	○	○
	Facsimile			○	○	○
	FDD (Floppy disk drive)			○	○	○
	HDD (Hard disk drive)			○	○	○
	CD-ROM	○				○
Industrial machinery	Vending machines	○		○	○	○
	Measuring instruments (meter, etc.)	○		○	○	○
	FA robots			○	○	○
	Sequencers				○	○
	AC servo motor				○	
Automotive electronic equipment	Antiskid control				○	
	Engine control				○	
	Air bag control	○			○	
	Dashboard related	○		○	○	○

3.1 Application System Examples

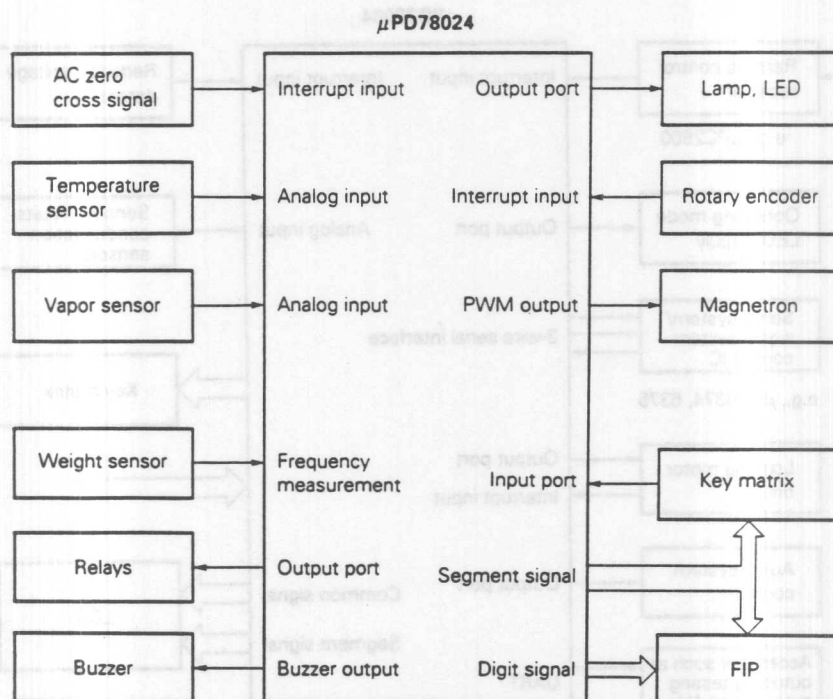
3.1.1 Compact disk player (mass-produced model)



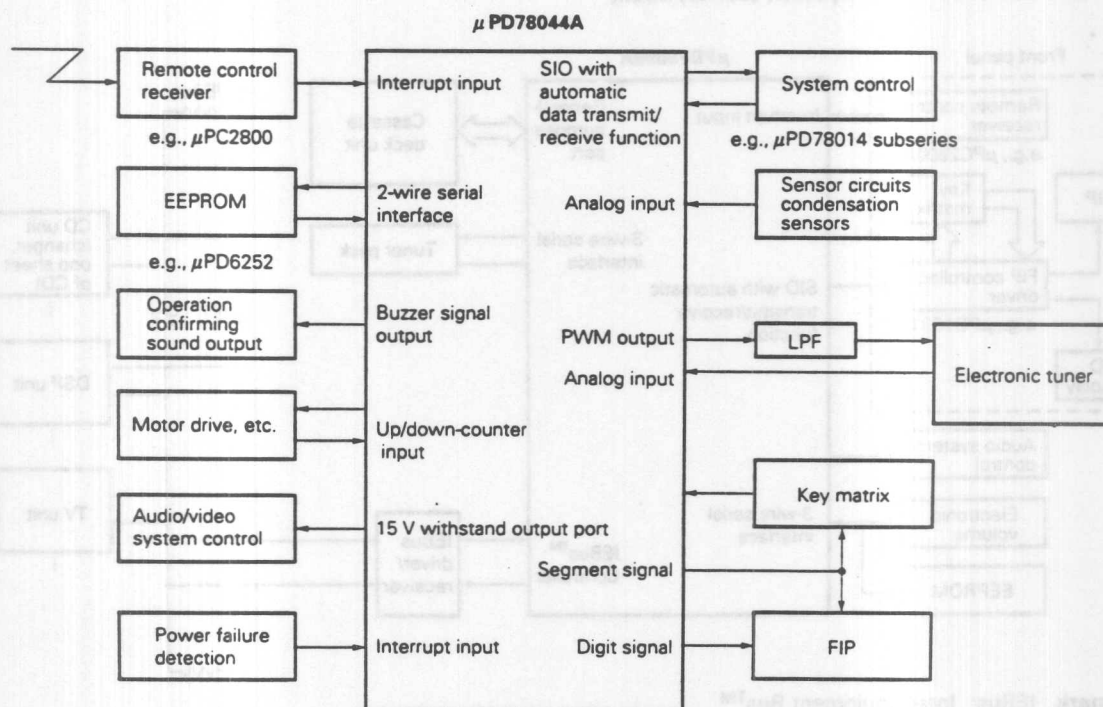
3.1.2 VCR (system component)



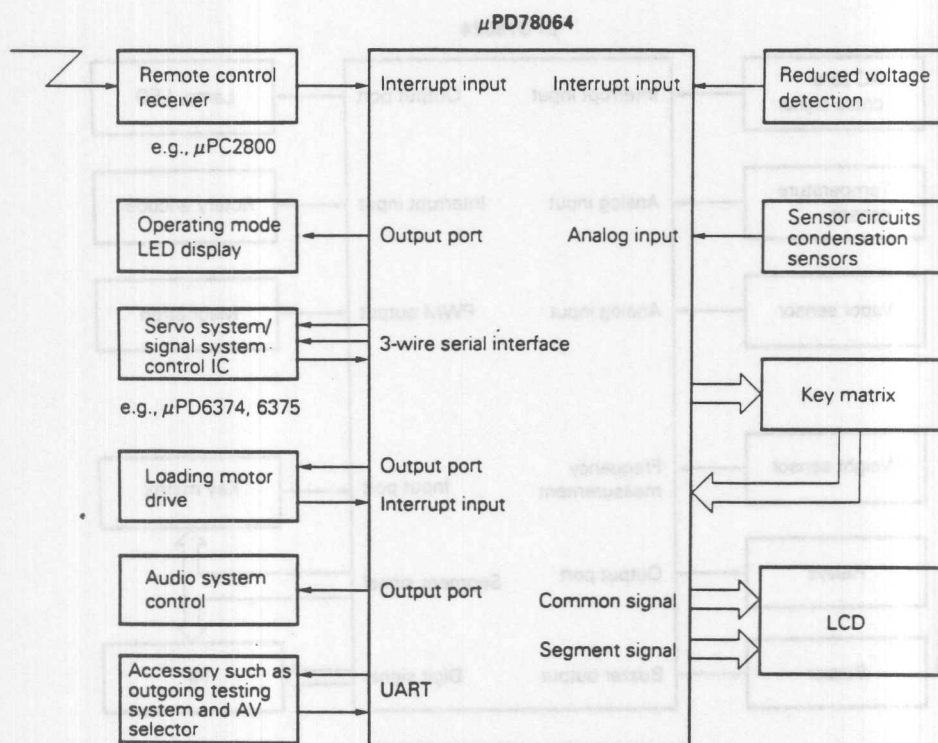
3.1.3 Microwave oven



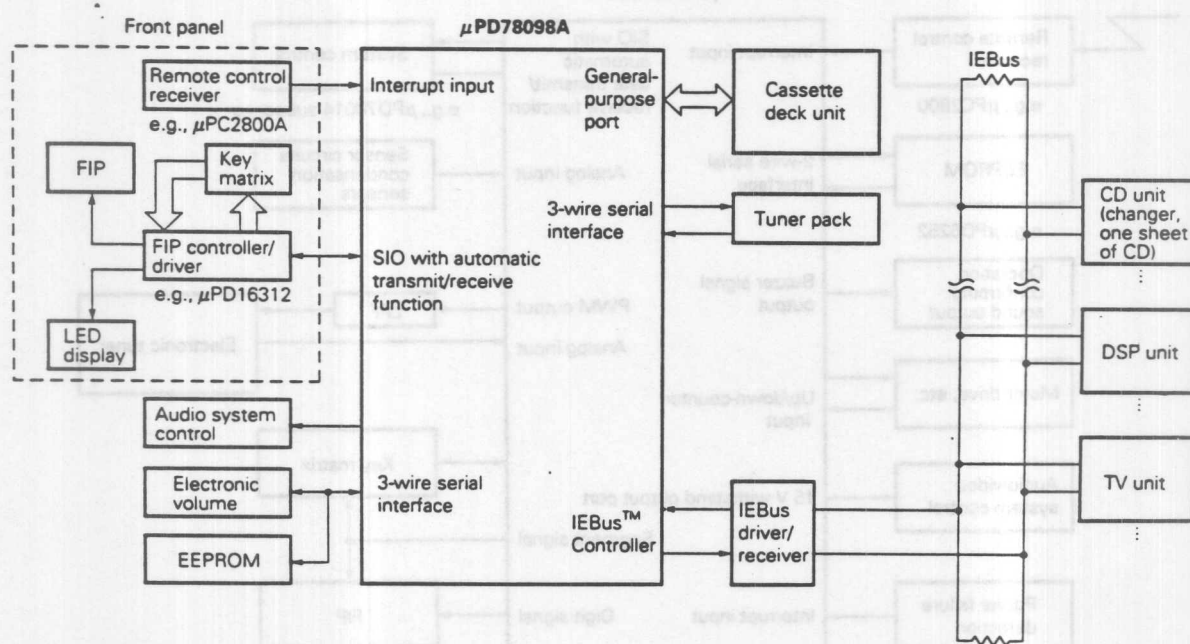
3.1.4 VCR timer



3.1.5 Portable CD player

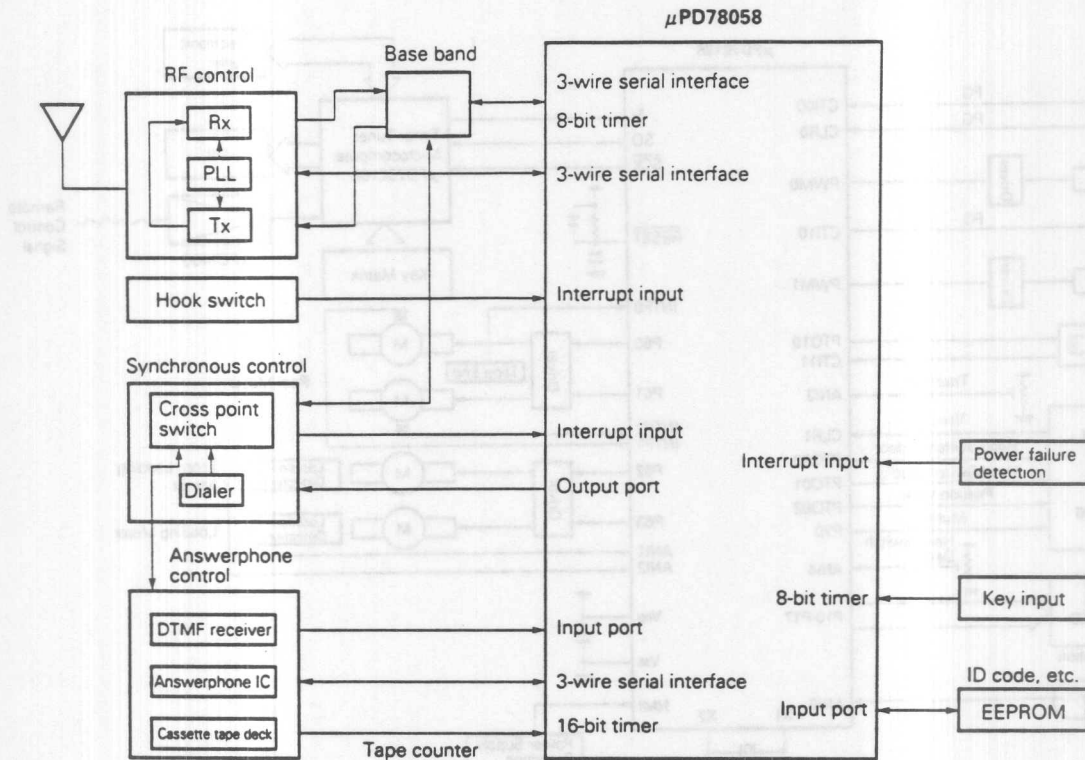


3.1.6 Car-mounted audio system (tuner/deck)

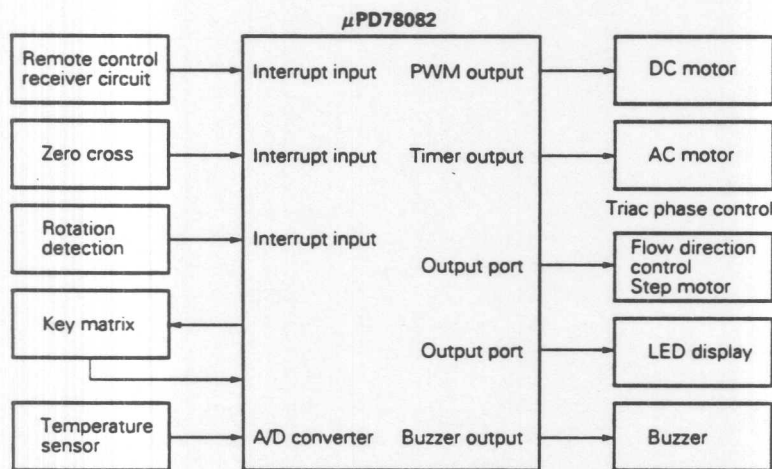


Remark IEBus: Inter Equipment Bus™

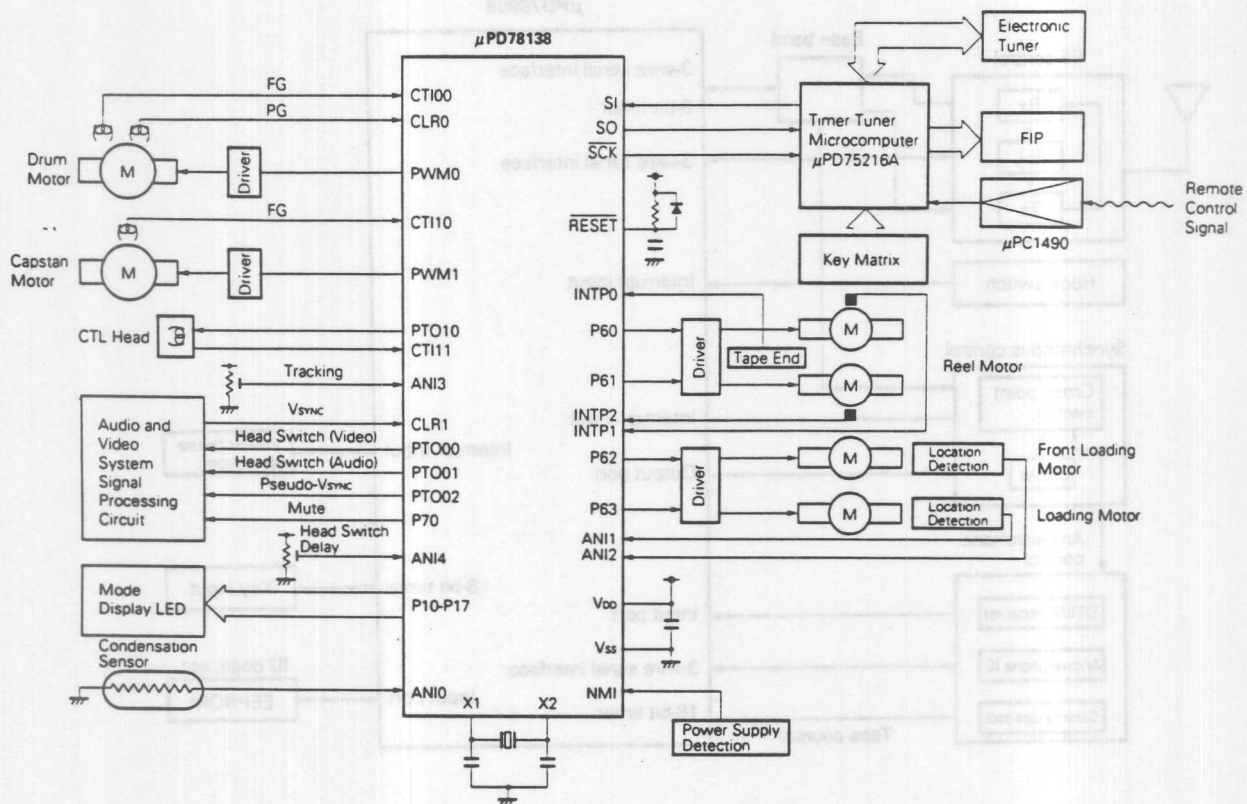
3.1.7 Cordless telephone base unit



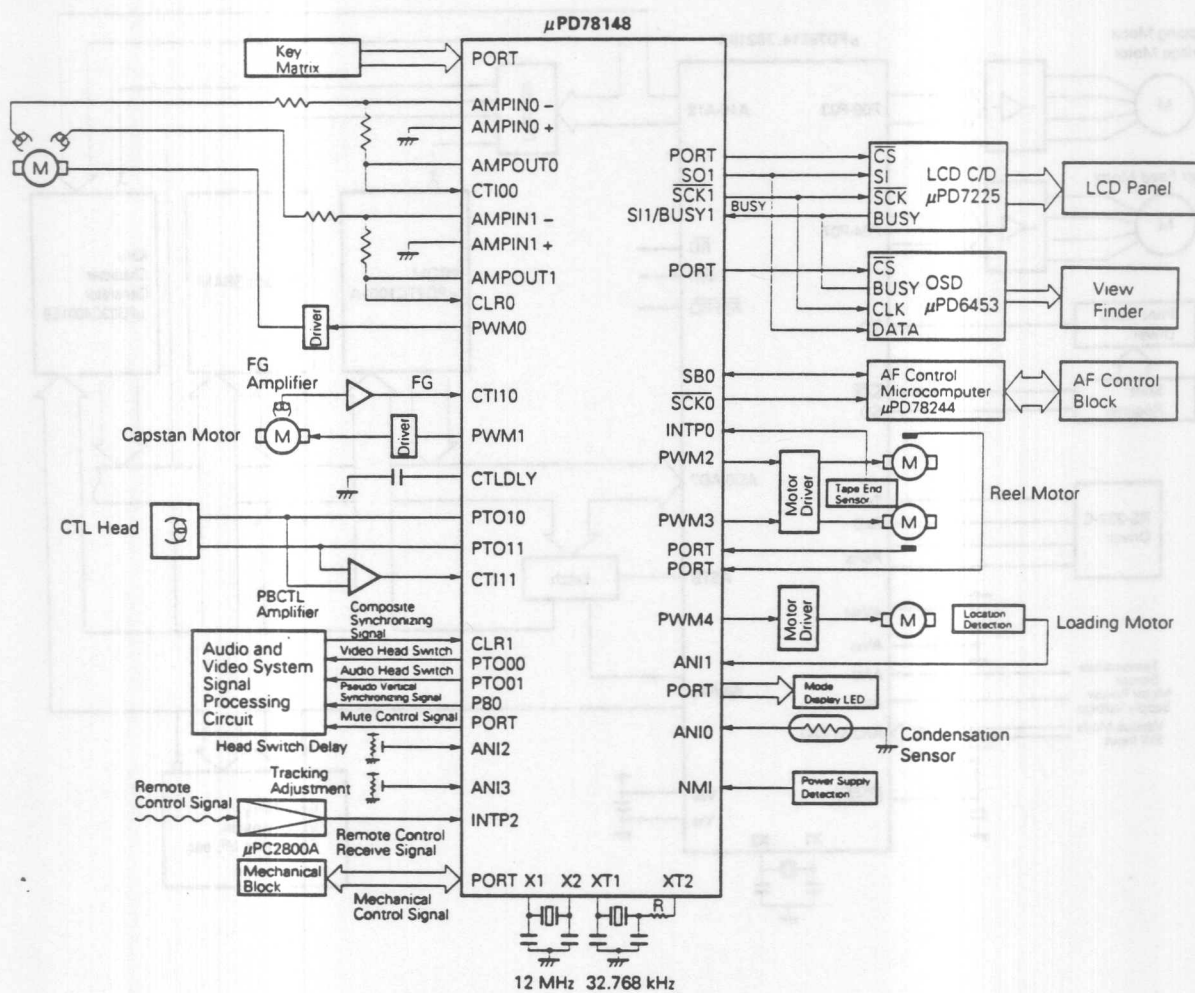
3.1.8 Air Conditioner



3.1.9 Deck type VCR



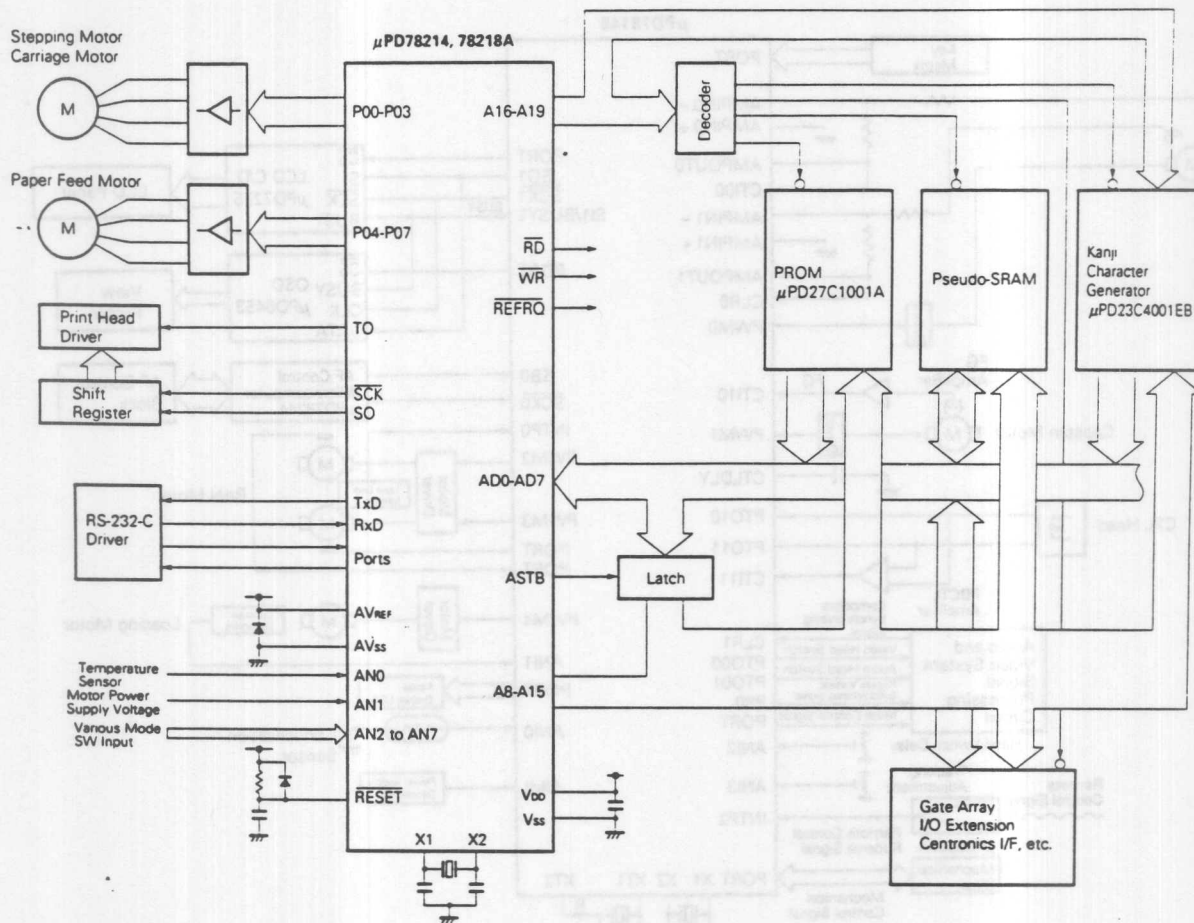
3.1.10 Handy video camcorder



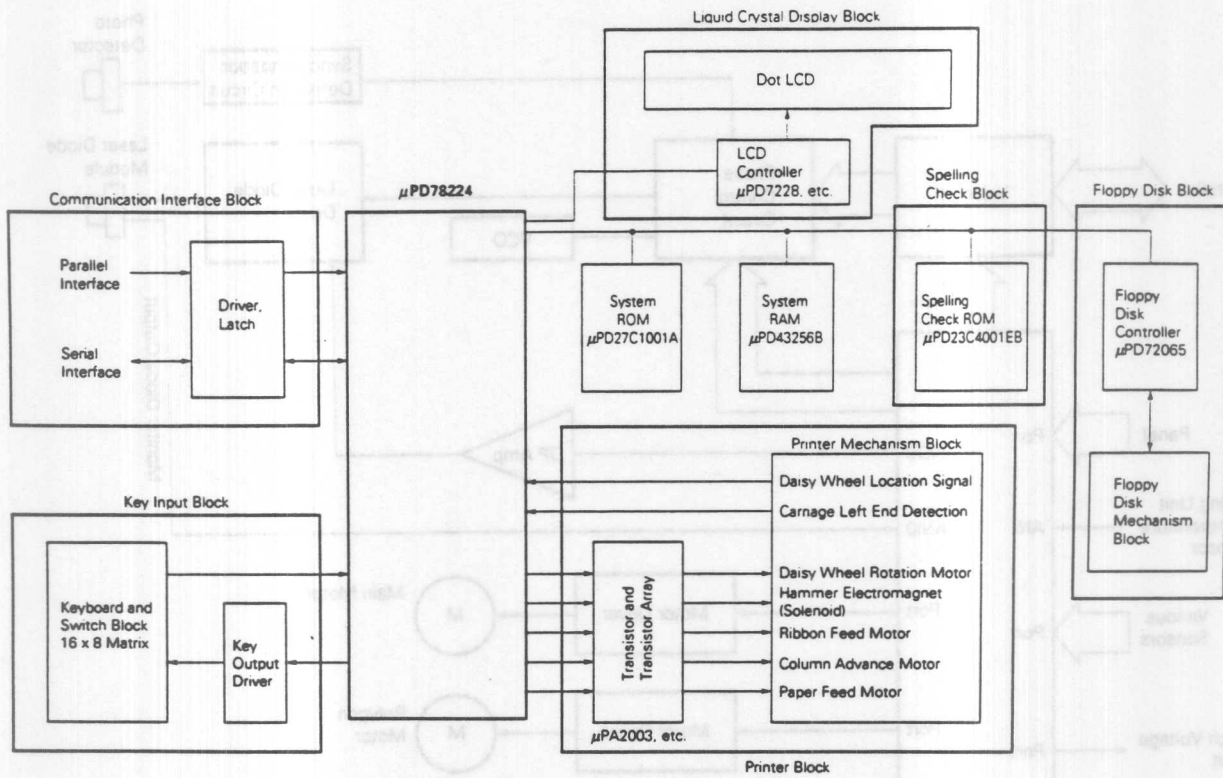
[Main system clock] [Subsystem clock]

Remark OSD: On Screen Display

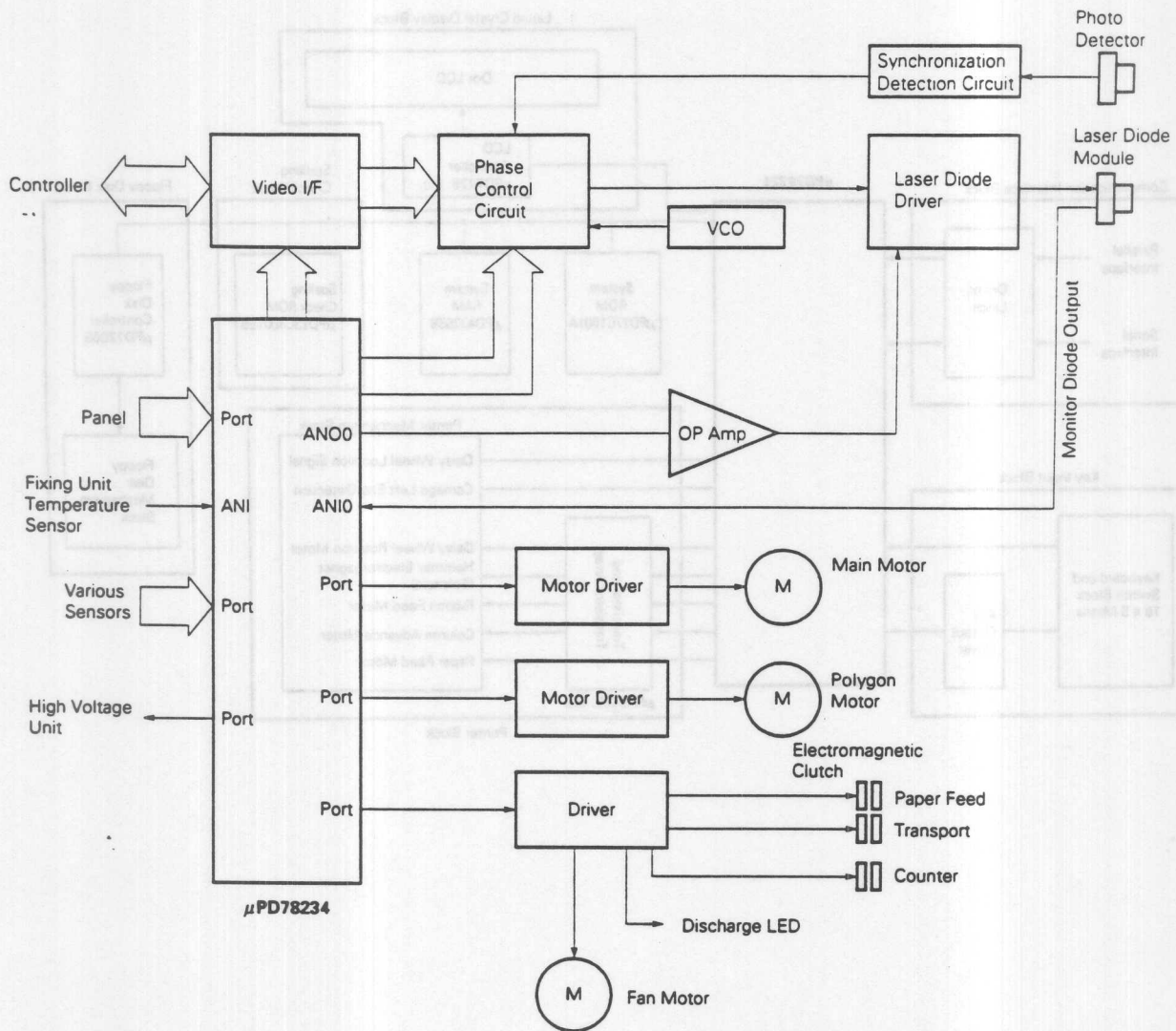
3.1.11 Printer



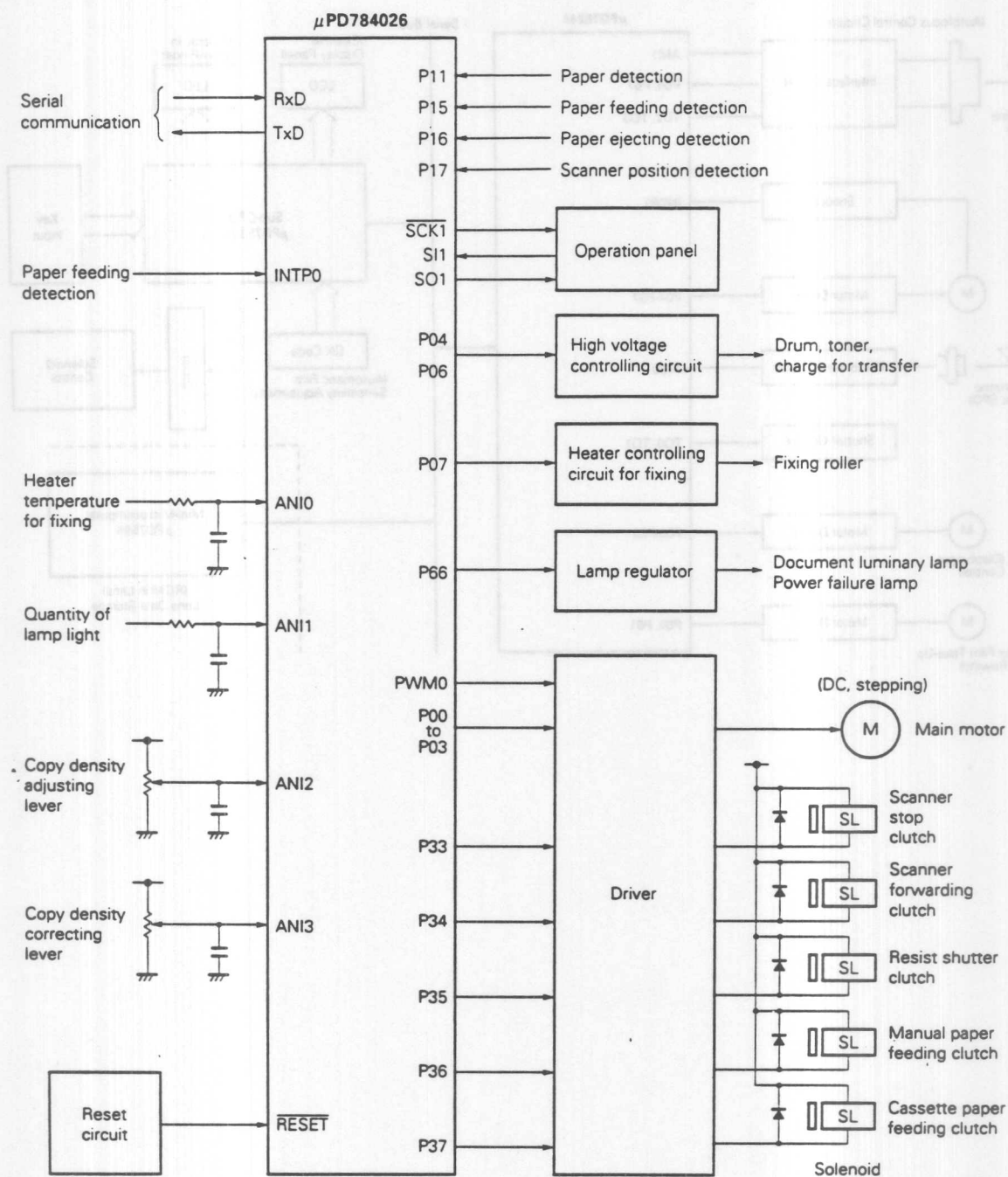
3.1.12 Electronic typewriter



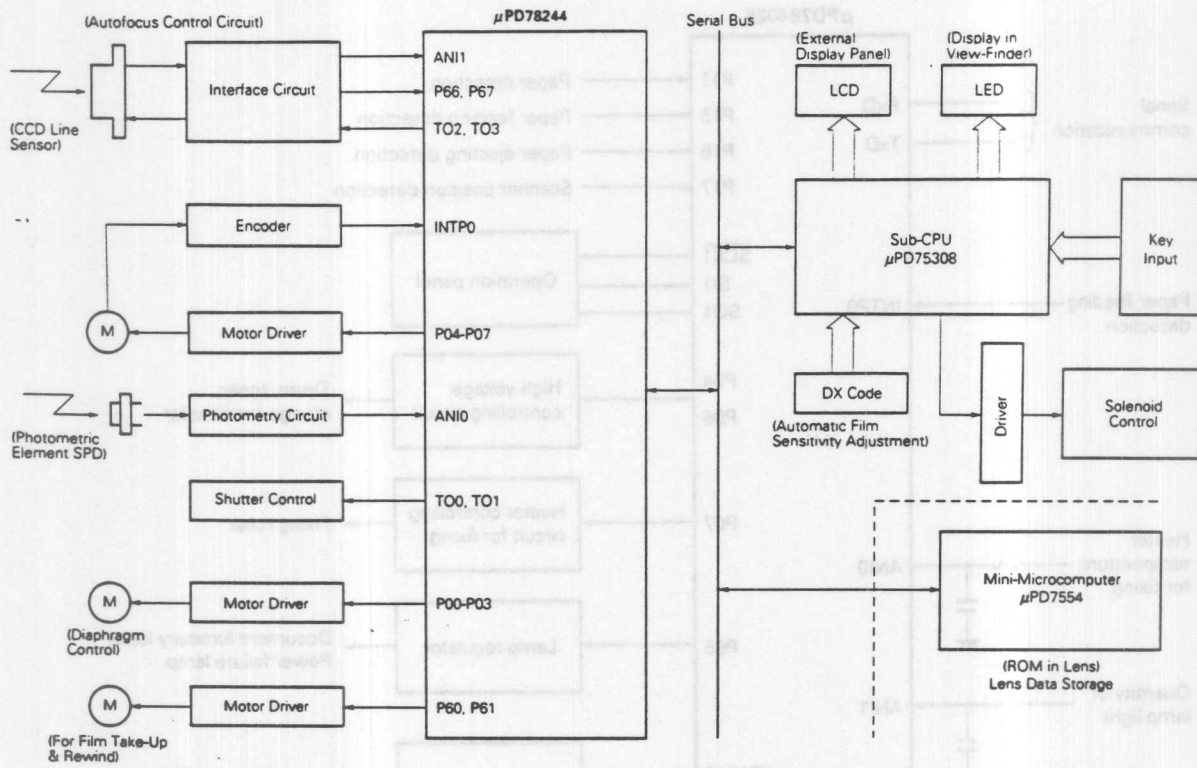
3.1.13 Laser beam printer (LBP) engine



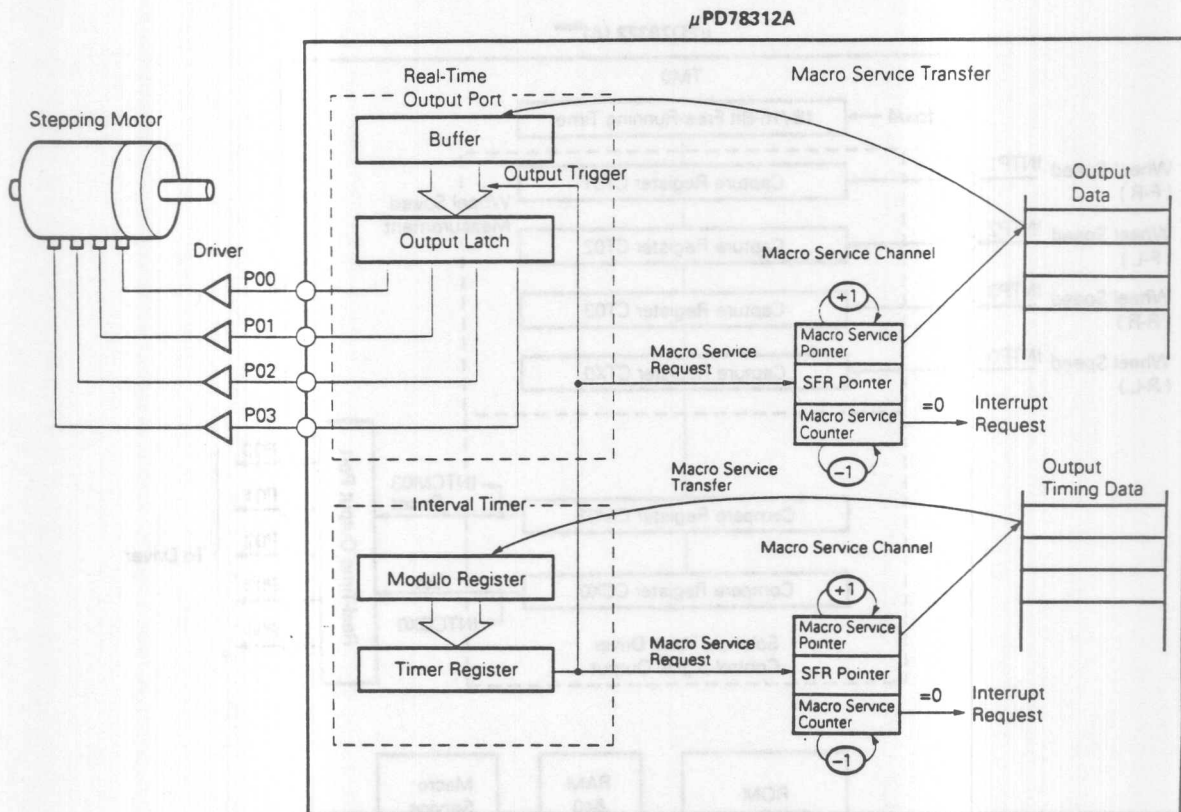
3.1.14 PPC



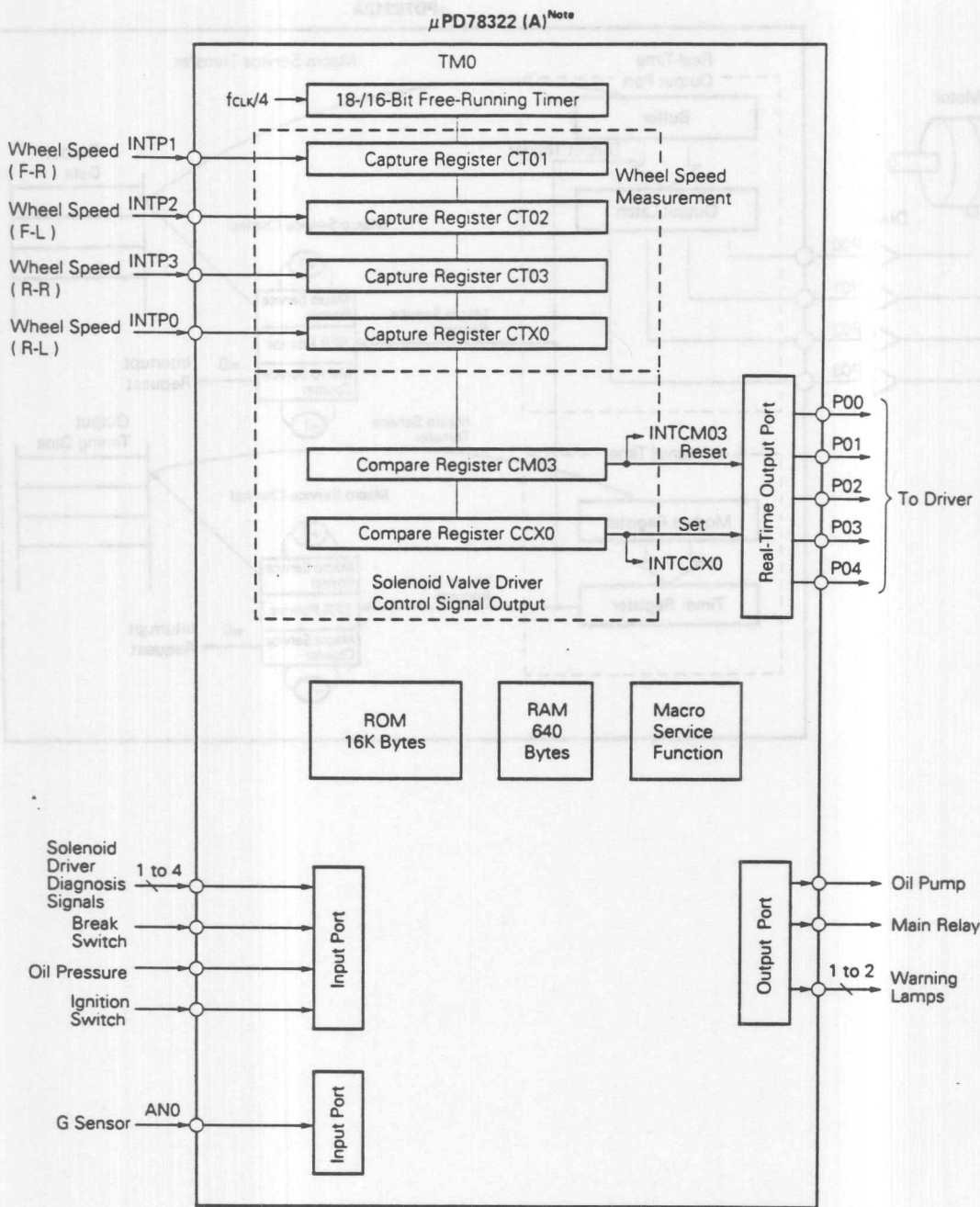
3.1.15 Autofocus single-lens reflex camera



3.1.16 Stepping motor control

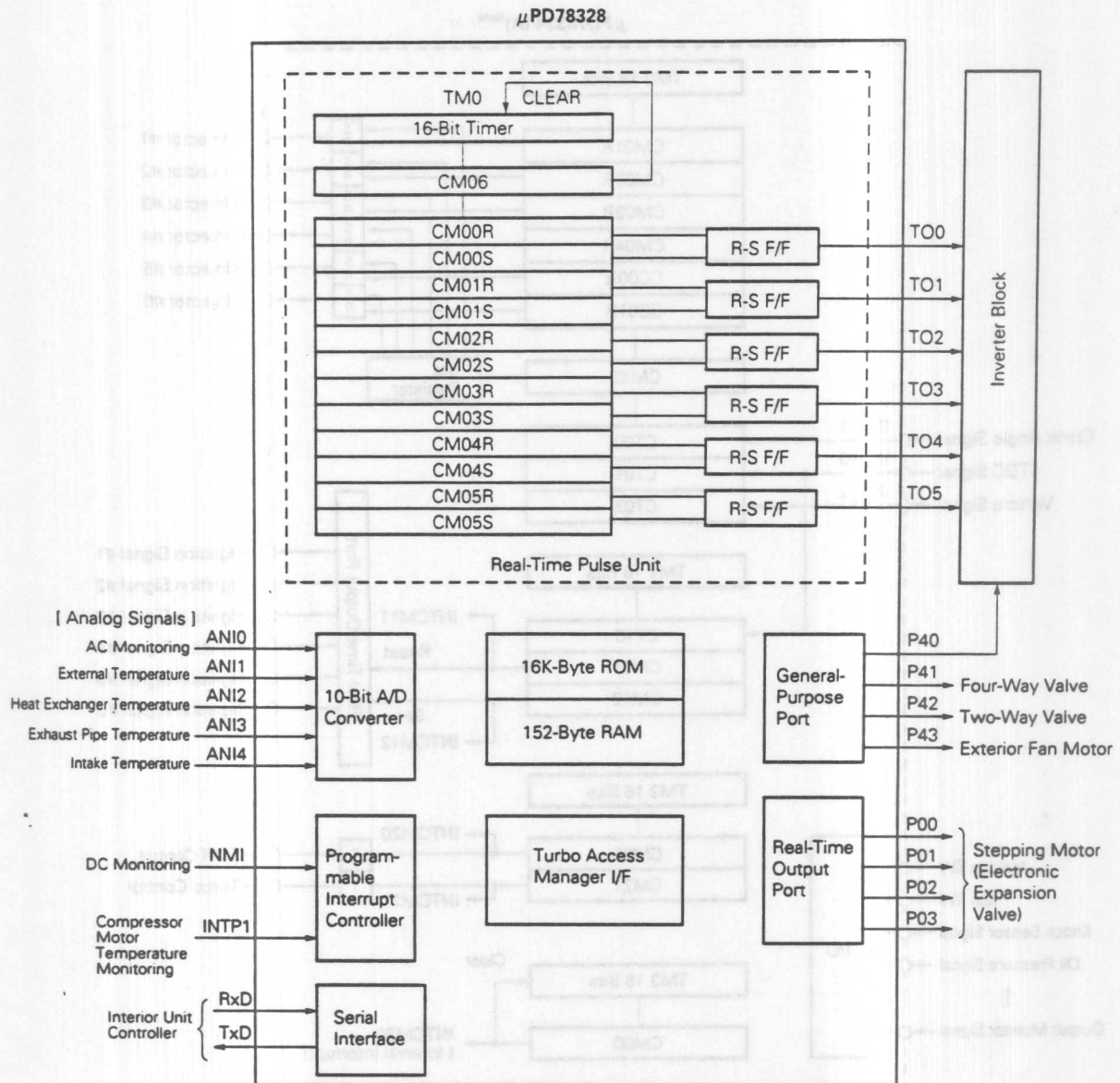


3.1.17 Antiskid control

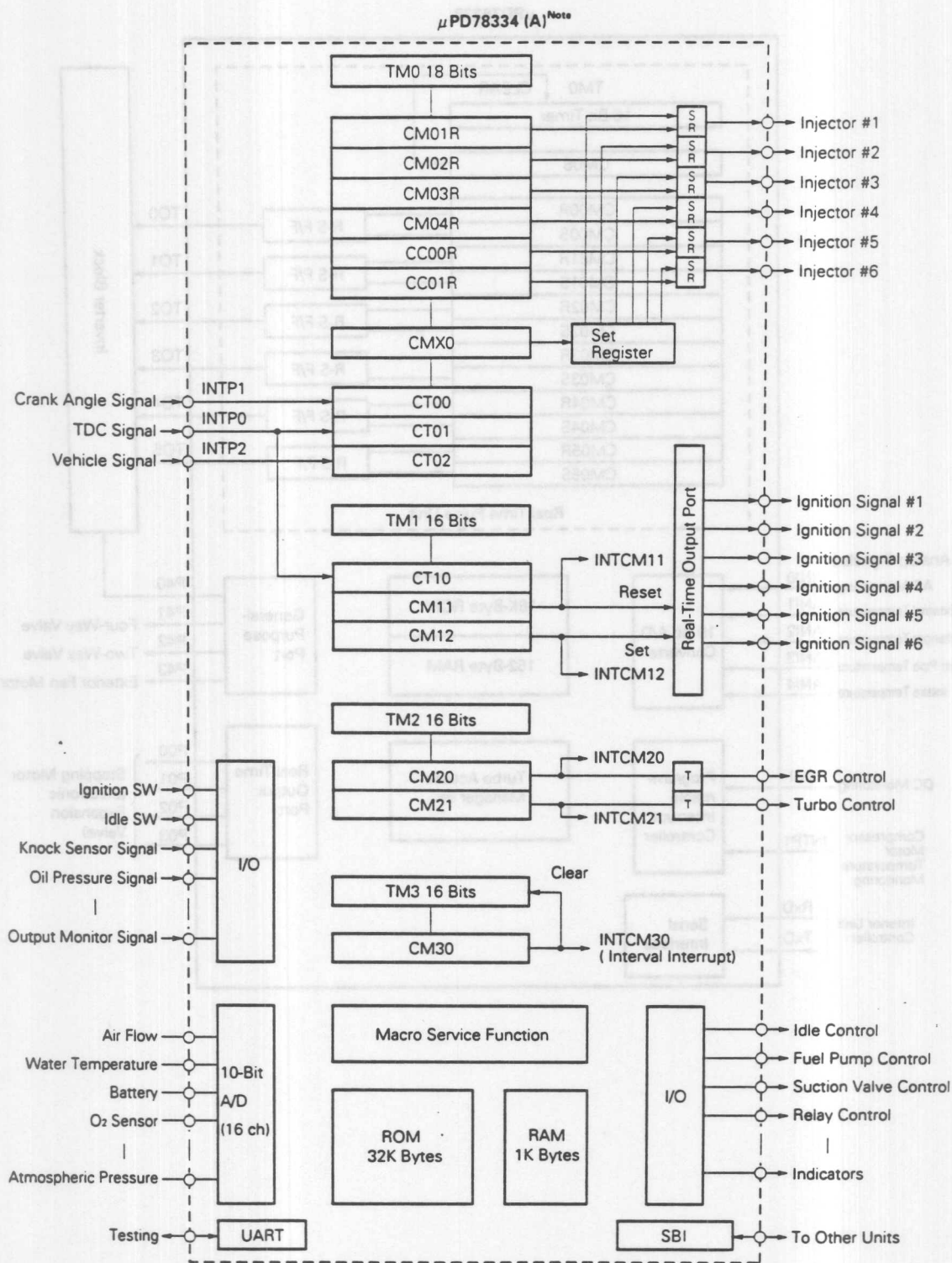


Note Special Quality Grade Product

3.1.18 Inverter air conditioner exterior unit control

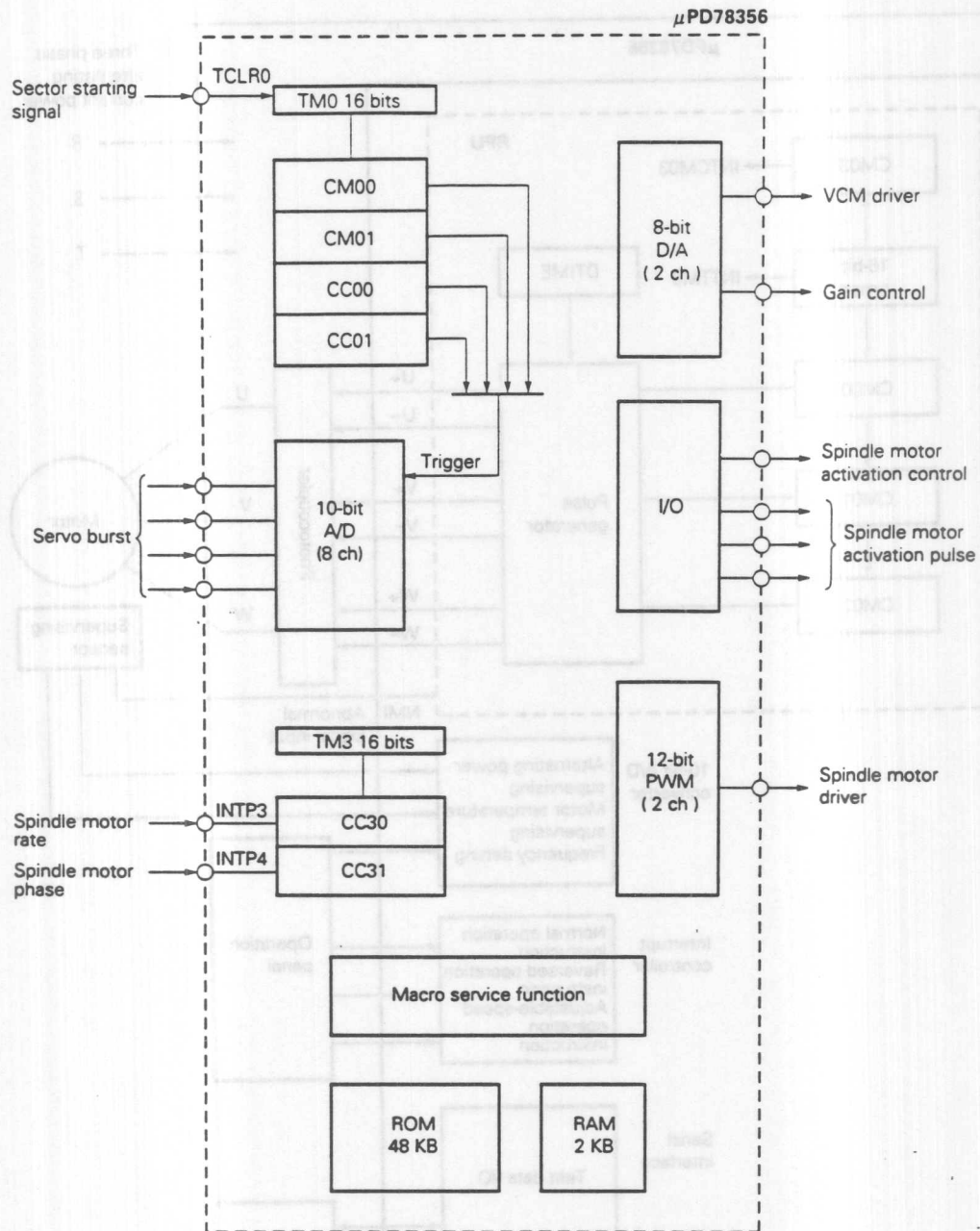


3.1.19 Engine control

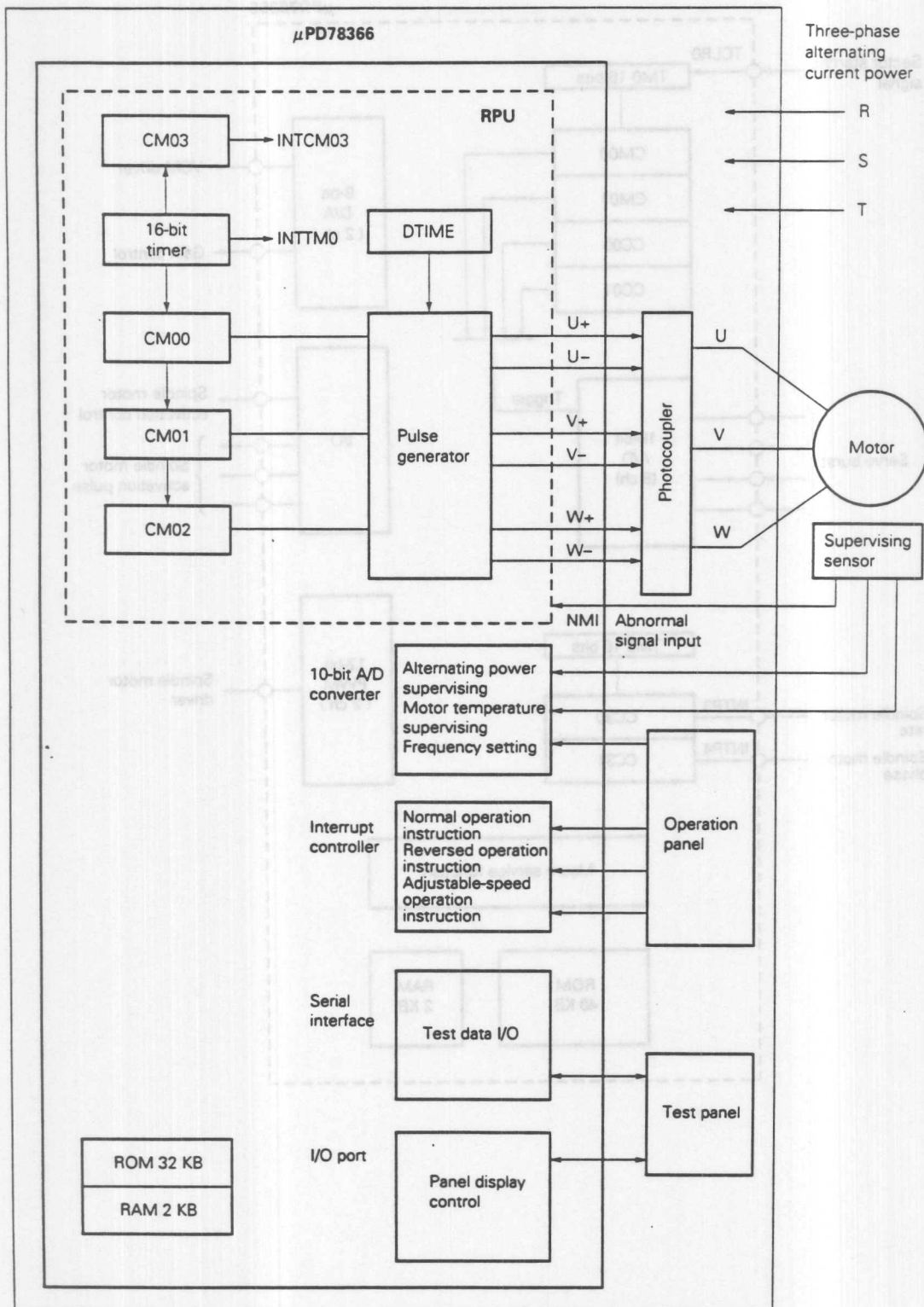


Note Special Quality Grade Product

3.1.20 Hard disk servo control system



3.1.21 General purpose servo controller



4. 78K SERIES PRODUCTS

4.1 Individual Series Features

Individual series have the following features.

Table 4-1. Series Features (1/2)

	Series	Features
	Subseries	
78K/0	μPD78002 μPD78014 μPD78024 μPD78044A μPD78054 μPD78064 μPD78078 μPD78083* μPD78098 μPD78002Y μPD78014Y μPD78054Y	<ul style="list-style-type: none"> ● Wide range of operating power voltage: 1.8 to 5.5 V (μPD78078, 78083 subseries only) 2.0 to 6.0 V (μPD78054, 78054Y, 78064 subseries only) 2.7 to 6.0 V (other than above) ● Low current dissipation ● Serial interface function with automatic transmit/receive function (other than μPD78002, 78002Y, 78024, 78064, 78083 subseries) ● On-chip FIP controller/driver (μPD78024, 78044A subseries only) ● On-chip 6-bit up/down counter (μPD78044A subseries only) ● On-chip LCD controller/driver (μPD78064 subseries only) ● On-chip UART (μPD78054, 78054Y, 78064, 78078, 78098 subseries only) ● On-chip IEBus controller (μPD78098 subseries only) ● On-chip I²C bus interface (μPD78002Y, 78014Y, 78054Y subseries only)
78K/I	μPD78138 μPD78148	<ul style="list-style-type: none"> ● On-chip multi-function timer set (super timer unit) enabling simple implementation of digital servo control ● Variety of on-chip hardware for VCR servo control and system control ● Variety of peripheral hardware including A/D converter, PWM outputs, etc.
78K/II	μPD78214 μPD78218A μPD78224 μPD78234 μPD78244	<ul style="list-style-type: none"> ● Enhanced external memory expansion function (1M-byte address space) ● On-chip pulse output function suitable for stepping motor control and real-time control ● Comprehensive product line-up and range of packages <ul style="list-style-type: none"> ● On-chip A/D converter products (other than μPD78224 subseries) ● Multiple on-chip I/O products ● On-chip D/A converter product (μPD78234 subseries only) ● On-chip EEPROM product (μPD78244 only)

*: Under development

Remark IEBus: Inter Equipment Bus

Table 4-1. Series Features (2/2)

Series		Features
	Subseries	
78K/III	μ PD78312A	● Powerful pulse output function
	μ PD78322	● High-resolution (10-bit) on-chip A/D converter (μ PD78312A subseries has an 8-bit on-chip A/D converter: μ PD78352A subseries does not.)
	μ PD78328	
	μ PD78334	● On-chip high-speed multiplication/division instructions for various applications, and data string instructions to facilitate processing of large volumes of data
	μ PD78352A	
	μ PD78356*	● Wide range of application areas from real-time control to ASIC controller use
	μ PD78366*	● On-chip D/A converter (μ PD78356 subseries only)
	μ PD78372*	
78K/IV	μ PD784026*	● Wide range of operating power supply voltage: 2.7 to 6.0 V
	(78K/II+)	● Large memory space (1M byte for program, 16M bytes for data) ● Containing 78K/II+ subseries which is pin-to-pin compatible with 78K/II series ● Low power consumption and many power management modes

*: Under development

4.2 Function Lists

78K/0 Series (1/12)

Part number		μ PD78001B	μ PD78002B	μ PD78P014
Function				
In full production/ under development		In full production		
Basic instruction		61		
Internal memory	ROM	8 K bytes (Mask ROM)	16 K bytes (Mask ROM)	32 K bytes (PROM)
	Internal high-speed RAM	256 bytes	384 bytes	1024 bytes
	Buffer RAM	None		32 bytes
Memory space		64 K bytes		
General register		8 bits \times 32 registers (8 bits \times 8 registers \times 4 banks)		
Instruction cycle		On-chip variable function for instruction execution time		
	Main system clock selection	0.4 μ s/0.8 μ s/1.6 μ s/3.2 μ s/6.4 μ s (@ 10 MHz)		
	Subsystem clock selection	122 μ s (@ 32.768 kHz)		
I/O port		53		
	CMOS input	2		
	CMOS I/O	47		
	N-ch open drain I/O (withstand voltage: 15 V)	4		
Serial interface		<ul style="list-style-type: none"> 3-wire/SBI/2-wire mode 		
Timer		<ul style="list-style-type: none"> 8-bit timer/event counter : 2 channels Watch timer : 1 channel Watchdog timer : 1 channel 		
Timer output		2		
Clock output		39.1 kHz, 78.1 kHz, 156 kHz, 313 kHz, 625 kHz, 1.25 MHz (@ main system clock of 10 MHz) 32.768 kHz (@ subsystem clock of 32.768 kHz)		
Buzzer output		2.4 kHz, 4.9 kHz, 9.8 kHz (@ main system clock of 10 MHz)		
Vectored interrupt		11		
	Maskable	Internal: 5, External: 4		
	Nonmaskable	Internal: 1		
	Software	Internal: 1		
Test input		Internal: 1, External: 1		
Operating power supply voltage		V_{DD} = 2.7 to 6.0 V		
Operating ambient temperature		-40 to +85 °C		
Package		<ul style="list-style-type: none"> 64-pin plastic shrink DIP (750 mil) 64-pin plastic QFP (14 \times 14 mm) 64-pin ceramic shrink DIP with window (750 mil): μPD78P014 only 		

78K/0 Series (2/12)

Function		Part number	μ PD78011B	μ PD78012B	μ PD78013	μ PD78014	μ PD78P014
In full production/ under development			In full production				
Basic instruction			63				
Internal memory	ROM		8 K bytes (Mask ROM)	16 K bytes (Mask ROM)	24 K bytes (Mask ROM)	32 K bytes (Mask ROM)	32 K bytes (PROM)
	Internal high-speed RAM		512 bytes		1024 bytes		
	Buffer RAM		32 bytes				
Memory space			64 K bytes				
General register			8 bits \times 32 registers (8 bits \times 8 registers \times 4 banks)				
Instruction cycle			On-chip variable function for instruction execution time				
	Main system clock selection		0.4 μ s/0.8 μ s/1.6 μ s/3.2 μ s/6.4 μ s (@ 10.0 MHz)				
	Subsystem clock selection		122 μ s (@ 32.768 kHz)				
I/O port			53				
	CMOS input		2				
	CMOS I/O		47				
	N-ch open drain I/O (withstand voltage: 15 V)		4				
A/D converter			<ul style="list-style-type: none">8-bit resolution \times 8 channelsOperate within wide power supply voltage range: $V_{DD} = 2.7$ to 6.0 V				
Serial interface			<ul style="list-style-type: none">3-wire/SBI/2-wire mode: 1 channel3-wire mode (On-chip maximum 32-byte automatic transmit/receive function) : 1 channel				
Timer			<ul style="list-style-type: none">16-bit timer/event counter : 1 channel8-bit timer/event counter : 2 channelsWatch timer : 1 channelWatchdog timer : 1 channel				
Timer output			3 (14-bit PWM output: 1)				
Clock output			39.1 kHz, 78.1 kHz, 156 kHz, 313 kHz, 625 kHz, 1.25 MHz (@ main system clock of 10.0 MHz) 32.768 kHz (@ subsystem clock of 32.768 kHz)				
Buzzer output			2.4 kHz, 4.9 kHz, 9.8 kHz (@ main system clock of 10.0 MHz)				
Vectored interrupt			14				
	Maskable		Internal: 8, External: 4				
	Nonmaskable		Internal: 1				
	Software		Internal: 1				
Test input			Internal: 1, External: 1				
Operating power supply voltage			$V_{DD} = 2.7$ to 6.0 V				
Operating ambient temperature			-40 to +85 $^{\circ}$ C				
Package			<ul style="list-style-type: none">64-pin plastic shrink DIP (750 mil)64-pin plastic QFP (14 \times 14 mm)64-pin ceramic shrink DIP with window (750 mil): μPD78P014 only				

78K/0 Series (3/12)

Part number		μ PD78023	μ PD78024	μ PD78P024
Function		In full production		Under development
In full production/ under development		In full production		Under development
Basic instruction		63		
Internal memory	ROM	24 K bytes (Mask ROM)	32 K bytes (Mask ROM)	32 K bytes (PROM)
	Internal high-speed RAM	512 bytes		
	FIP displaying RAM	32 bytes		
Memory space		64 K bytes		
General register		8 bits x 32 registers (8 bits x 8 registers x 4 banks)		
Instruction cycle		On-chip variable function for instruction execution time		
	Main system clock selection	0.4 μ s/0.8 μ s/1.6 μ s/3.2 μ s/6.4 μ s (@ 5.0 MHz)		
	Subsystem clock selection	122 μ s (@ 32.768 kHz)		
I/O port		54		
	CMOS input	2		
	CMOS I/O	26		
	P-ch open drain I/O	8		
	P-ch open drain output	18		
A/D converter		<ul style="list-style-type: none"> • 8-bit resolution x 8 channels • Operating power supply voltage range: $V_{DD} = 4.5$ to 5.5 V 		
FIP controller/driver		Total of display outputs : 26 <ul style="list-style-type: none"> • Number of segments : 9 to 16 • Number of digits : 2 to 16 		
Serial interface		<ul style="list-style-type: none"> • 3-wire/SBI/2-wire mode : 1 channel • 3-wire mode : 1 channel 		
Timer		<ul style="list-style-type: none"> • 16-bit timer/event counter : 1 channel • 8-bit timer/event counter : 2 channels • Watch timer : 1 channel • Watchdog timer : 1 channel 		
Timer output		3 (14-bit PWM output: 1)		
Clock output		19.5 kHz, 39.1 kHz, 78.1 kHz, 156 kHz, 313 kHz, 625 kHz (@ main system clock of 5.0 MHz) 32.768 kHz (@ subsystem clock of 32.768 kHz)		
Buzzer output		1.2 kHz, 2.4 kHz, 4.9 kHz (@ main system clock of 5.0 MHz)		
Vectored interrupt		15		
	Maskable	Internal: 9, External: 4		
	Nonmaskable	Internal: 1		
	Software	Internal: 1		
Test input		Internal: 1		
Operating power supply voltage		$V_{DD} = 2.7$ to 6.0 V		
Operating ambient temperature		-40 to $+85$ °C		
Package		<ul style="list-style-type: none"> • 64-pin plastic shrink DIP (750 mil) • 64-pin plastic QFP (14 x 20 mm) • 64-pin ceramic shrink DIP with window (750 mil): μPD78P024 only 		

78K/0 Series (4/12)

Function		Part number	μ PD78042A	μ PD78043A	μ PD78044A	μ PD78045A	μ PD78P048A
In full production/ under development			In full production				Under development
Basic instruction			63				
Internal memory	ROM	16 K bytes (Mask ROM)	24 K bytes (Mask ROM)	32 K bytes (Mask ROM)	40 K bytes (Mask ROM)	60 K bytes (PROM)	
	Internal high-speed RAM	512 bytes			1024 bytes		
	Buffer RAM	64 bytes					
	FIP displaying RAM	48 bytes					
	Internal extension RAM	None					1024 bytes
Memory space			64 K bytes				
General register			8 bits \times 32 registers (8 bits \times 8 registers \times 4 banks)				
Instruction cycle			On-chip variable function for instruction execution time				
	Main system clock selection	0.4 μ s/0.8 μ s/1.6 μ s/3.2 μ s/6.4 μ s (@ 5.0 MHz)					
	Subsystem clock selection	122 μ s (@ 32.768 kHz)					
I/O port			68				
	CMOS input	2					
	CMOS I/O	27					
	N-ch open drain I/O	5					
	P-ch open drain I/O	16					
	P-ch open drain output	18					
A/D converter			<ul style="list-style-type: none">8-bit resolution \times 8 channelsOperating power supply voltage range: $V_{DD} = 4.0$ to 6.0 V				
FIP controller/driver			Total of display outputs : 34 <ul style="list-style-type: none">Number of segments : 9 to 24Number of digits : 2 to 16				
Serial interface			<ul style="list-style-type: none">3-wire/SBI/2-wire mode: 1 channel3-wire mode (On-chip maximum 64-byte automatic transmit/receive function) : 1 channel				
Timer			<ul style="list-style-type: none">16-bit timer/event counter : 1 channel8-bit timer/event counter : 2 channelsWatch timer : 1 channelWatchdog timer : 1 channel6-bit up/down counter : 1 channel				
Timer output			3 (14-bit PWM output: 1)				
Clock output			16.4 kHz, 32.7 kHz, 65.5 kHz, 131 kHz, 262 kHz, 524 kHz (@ main system clock of 4.19 MHz) 32.768 kHz (@ subsystem clock of 32.768 kHz)				
Buzzer output			1 kHz, 2 kHz, 4 kHz (@ main system clock of 4.19 MHz)				
Vectored interrupt			16				
	Maskable	Internal: 10, External: 4					
	Nonmaskable	Internal: 1					
	Software	Internal: 1					
Test input			Internal: 1				
Operating power supply voltage			$V_{DD} = 2.7$ to 6.0 V				
Operating ambient temperature			-40 to $+85$ $^{\circ}$ C				
Package			<ul style="list-style-type: none">80-pin plastic QFP (14 \times 20 mm)80-pin ceramic WQFN (14 \times 20 mm): μPD78P048A only				

78K/0 Series (5/12)

Part number		μ PD78052	μ PD78053	μ PD78054	μ PD78P054	μ PD78055	μ PD78056	μ PD78058	μ PD78P058
Function		In full production							
In full production/ under development									
Basic instruction		63							
Internal memory	ROM	16 K bytes (Mask ROM)	24 K bytes (Mask ROM)	32 K bytes (Mask ROM)	32 K bytes (PROM)	40 K bytes (Mask ROM)	48 K bytes (Mask ROM)	60 K bytes (Mask ROM)	60 K bytes (PROM)
	Internal high-speed RAM	512 bytes	1024 bytes						
	Buffer RAM	32 bytes							
	Internal extension RAM	None							1024 bytes
Memory space		64 K bytes							
General register		8 bits \times 32 registers (8 bits \times 8 registers \times 4 banks)							
Instruction cycle		On-chip variable function for instruction execution time							
	Main system clock selection	0.4 μ s/0.8 μ s/1.6 μ s/3.2 μ s/6.4 μ s/12.8 μ s (@ 5.0 MHz)							
	Subsystem clock selection	122 μ s (@ 32.768 kHz)							
I/O port		69							
	CMOS input	2							
	CMOS I/O	63							
	N-ch open drain I/O	4							
A/D converter		<ul style="list-style-type: none">8-bit resolution \times 8 channelsOperate within wide power supply voltage range: $V_{DD} = 2.0$ to 6.0 V							
D/A converter		<ul style="list-style-type: none">8-bit resolution \times 2 channelsOperate within wide power supply voltage range: $V_{DD} = 2.0$ to 6.0 V							
Serial interface		<ul style="list-style-type: none">3-wire/SBI/2-wire mode: 1 channel3-wire mode (On-chip maximum 32-byte automatic transmit/receive function) : 1 channel3-wire/UART mode : 1 channel							
Timer		<ul style="list-style-type: none">16-bit timer/event counter : 1 channel8-bit timer/event counter : 2 channelsWatch timer : 1 channelWatchdog timer : 1 channel							
Timer output		3 (14-bit PWM output: 1)							
Clock output		19.5 kHz, 39.1 kHz, 78.1 kHz, 156 kHz, 313 kHz, 625 kHz, 1.25 MHz, 2.5 MHz, 5.0 MHz (@ main system clock of 5.0 MHz) 32.768 kHz (@ subsystem clock of 32.768 kHz)							
Buzzer output		1.2 kHz, 2.4 kHz, 4.9 kHz, 9.8 kHz (@ main system clock of 5.0 MHz)							
Vectored interrupt		22							
	Maskable	Internal: 13, External: 7							
	Nonmaskable	Internal: 1							
	Software	Internal: 1							
Test input		Internal: 1, External: 1							
Operating power supply voltage		$V_{DD} = 2.0$ to 6.0 V							
Operating ambient temperature		-40 to $+85$ $^{\circ}$ C							
Package		<ul style="list-style-type: none">80-pin plastic QFP (14 \times 14 mm)80-pin plastic TQFP (12 \times 12 mm): other than the μPD78P055, 78056, 78P058. μPD78058 is under development.80-pin ceramic WQFN (14 \times 14 mm)Note: μPD78P054, 78P058 only							

Note Under development

78K/0 Series (6/12)

Function		Part number	μ PD78074	μ PD78075	μ PD78076	μ PD78078	μ PD78P078
In full production/ under development			Under development		In full production	Under development	
Basic instruction			63				
Internal memory	ROM	32 K bytes (Mask ROM)	40 K bytes (Mask ROM)	48 K bytes (Mask ROM)	60 K bytes (Mask ROM)	60 K bytes (PROM)	
	Internal high-speed RAM	1024 bytes					
	Buffer RAM	32 bytes					
	Internal extension RAM	None			1024 bytes		
Memory space			64 K bytes				
General register			8 bits \times 32 registers (8 bits \times 8 registers \times 4 banks)				
Instruction cycle			On-chip variable function for instruction execution time				
	Main system clock selection	0.4 μ s/0.8 μ s/1.6 μ s/3.2 μ s/6.4 μ s/12.8 μ s (@ 5.0 MHz)					
	Subsystem clock selection	122 μ s (@ 32.768 kHz)					
I/O port			88				
	CMOS input	2					
	CMOS I/O	78					
	N-ch open drain I/O	8					
A/D converter			<ul style="list-style-type: none">8-bit resolution \times 8 channelsOperate within wide power supply voltage range: $V_{DD} = 1.8$ to 5.5 V				
D/A converter			<ul style="list-style-type: none">8-bit resolution \times 2 channelsOperate within wide power supply voltage range: $V_{DD} = 1.8$ to 5.5 V				
Serial interface			<ul style="list-style-type: none">3-wire/SBI/2-wire mode: 1 channel3-wire mode (On-chip maximum 32-byte automatic transmit/receive function) : 1 channel3-wire/UART mode : 1 channel				
Timer			<ul style="list-style-type: none">16-bit timer/event counter : 1 channel8-bit timer/event counter : 4 channelsWatch timer : 1 channelWatchdog timer : 1 channel				
Timer output			5 (14-bit PWM output: 1, 8-bit PWM output: 2)				
Clock output			19.5 kHz, 39.1 kHz, 78.1 kHz, 156 kHz, 313 kHz, 625 kHz, 1.25 MHz, 2.5 MHz, 5.0 MHz (@ main system clock of 5.0 MHz) 32.768 kHz (@ subsystem clock of 32.768 kHz)				
Buzzer output			1.2 kHz, 2.4 kHz, 4.9 kHz, 9.8 kHz (@ main system clock of 5.0 MHz)				
Vectored interrupt			24				
	Maskable	Internal: 15, External: 7					
	Nonmaskable	Internal: 1					
	Software	Internal: 1					
Test input			Internal: 1, External: 1				
Operating power supply voltage			$V_{DD} = 1.8$ to 5.5 V				
Operating ambient temperature			-40 to $+85$ $^{\circ}$ C				
Package			<ul style="list-style-type: none">100-pin plastic QFP (14 \times 14 mm)100-pin plastic QFP (14 \times 20 mm)100-pin ceramic WQFN (14 \times 20 mm): μPD78P078 only				

78K/0 Series (7/12)

Function		Part number	μ PD78062	μ PD78063	μ PD78064	μ PD78P064
In full production/ under development			In full production			
Basic instruction			63			
Internal memory	ROM		16 K bytes (Mask ROM)	24 K bytes (Mask ROM)	32 K bytes (Mask ROM)	32 K bytes (PROM)
	Internal high-speed RAM		512 bytes	1024 bytes		
	LCD displaying RAM		40 × 4 bits			
General register			8 bits × 32 registers (8 bits × 8 registers × 4 banks)			
Instruction cycle			On-chip variable function for instruction execution time			
	Main system clock selection		0.4 μ s/0.8 μ s/1.6 μ s/3.2 μ s/6.4 μ s/12.8 μ s (@ 5.0 MHz)			
	Subsystem clock selection		122 μ s (@ 32.768 kHz)			
I/O port			57			
	CMOS input		2			
	CMOS I/O		55			
A/D converter			<ul style="list-style-type: none">8-bit resolution × 8 channelsOperate within wide power supply voltage range: $V_{DD} = 2.0$ to 6.0 V			
LCD controller/driver			<ul style="list-style-type: none">Segment signal output : maximum 40Common signal output : maximum 4Bias changeover : 1/2 or 1/3 bias changeover is enableOperating power supply voltage : $V_{DD} = 2.0$ to 6.0 V (static display mode) $V_{DD} = 2.5$ to 6.0 V (1/3 bias) $V_{DD} = 2.7$ to 6.0 V (1/2 bias)			
Serial interface			<ul style="list-style-type: none">3-wire/SBI/2-wire mode : 1 channel3-wire/UART mode : 1 channel			
Timer			<ul style="list-style-type: none">16-bit timer/event counter : 1 channel8-bit timer/event counter : 2 channelsWatch timer : 1 channelWatchdog timer : 1 channel			
Timer output			3 (14-bit PWM output: 1)			
Clock output			19.5 kHz, 39.1 kHz, 78.1 kHz, 156 kHz, 313 kHz, 625 kHz, 1.25 MHz, 2.5 MHz, 5.0 MHz (@ main system clock of 5.0 MHz) 32.768 kHz (@ subsystem clock of 32.768 kHz)			
Buzzer output			1.2 kHz, 2.4 kHz, 4.9 kHz, 9.8 kHz (@ main system clock of 5.0 MHz)			
Vectored interrupt			20			
	Maskable		Internal: 12, External: 6			
	Nonmaskable		Internal: 1			
	Software		Internal: 1			
Test input			Internal: 1, External: 1			
Operating power supply voltage			$V_{DD} = 2.0$ to 6.0 V			
Operating ambient temperature			-40 to +85 °C			
Package			<ul style="list-style-type: none">100-pin plastic QFP (14 × 14 mm, 0.5 mm pitch)100-pin plastic QFP (14 × 20 mm, 0.65 mm pitch)100-pin ceramic WQFN (14 × 20 mm)Note: μPD78P064 only			

Note Under development

78K/0 Series (8/12)

Part number		μ PD78081	μ PD78082	μ PD78P083
Function				
In full production/ under development		Under development		
Basic instruction		63		
Internal memory	ROM	8 K bytes (Mask ROM)	16 K bytes (Mask ROM)	24 K bytes (PROM)
	Internal high-speed RAM	256 bytes	384 bytes	512 bytes
Memory space		64 K bytes		
General register		8 bits \times 32 registers (8 bits \times 8 registers \times 4 banks)		
Instruction cycle		On-chip variable function for instruction execution time 0.4 μ s/0.8 μ s/1.6 μ s/3.2 μ s/6.4 μ s/12.8 ms (@ Main system clock of 5.0 MHz)		
I/O port		33		
	CMOS input	2		
	CMOS I/O	32 (able to set an on-chip pull-up resistor to ON/OFF through the software)		
A/D converter		<ul style="list-style-type: none"> • 8-bit resolution \times 8 channels • Operate within wide power supply voltage range: $V_{DD} = 1.8$ to 5.5 V 		
Serial interface		<ul style="list-style-type: none"> • 3-wire UART mode: 1 channel 		
Timer		<ul style="list-style-type: none"> • 8-bit timer/event counter: 2 channels • Watchdog timer: 1 channel 		
Timer output		2 (8-bit PWM output: 2)		
Clock output		19.5 kHz, 39.1 kHz, 78.1 kHz, 156 kHz, 313 kHz, 625 kHz, 1.25 MHz, 2.5 MHz, 5.0 MHz (@ Main system clock of 5.0 MHz)		
Buzzer output		1.2 kHz, 2.4 kHz, 4.9 kHz, 9.8 kHz (@ Main system clock of 5.0 MHz)		
Vectored interrupt		13		
	Maskable	Internal: 8, External: 3		
	Nonmaskable	Internal: 1		
	Software	Internal: 1		
Operating power supply voltage		$V_{DD} = 1.8$ to 5.5 V		
Operating ambient temperature		-40 to +85°C		
Package		<ul style="list-style-type: none"> • 42-pin plastic shrink DIP (600 mil) • 44-pin plastic QFP (10 \times 10 mm) • 42-pin ceramic shrink DIP with window (600 mil): μPD78P083 only 		

78K/0 Series (9/12)

Part number		μ PD78094	μ PD78095	μ PD78096	μ PD78098A	μ PD78P098A
Function						
In full production/ under development		In full production			Under development	
Basic instruction		63				
Internal memory	ROM	32 K bytes (Mask ROM)	40 K bytes (Mask ROM)	48 K bytes (Mask ROM)	60 K bytes (Mask ROM)	60 K bytes (PROM)
	Internal high-speed RAM	1024 bytes				
	Buffer RAM	32 bytes				
	Internal expansion RAM	None			2048 bytes	
Memory space		64 K bytes				
General register		8 bits \times 32 registers (8 bits \times 8 registers \times 4 banks)				
Instruction cycle		On-chip variable function for instruction execution time				
	Main system clock selection	0.5 μ s/1.0 μ s/2.0 μ s/4.0 μ s/8.0 μ s/16.0 μ s (@ 6.0 MHz)				
	Subsystem clock selection	122 μ s (@ 32.768 kHz)				
I/O port		69				
	CMOS input	2				
	CMOS I/O	63				
	N-ch open drain I/O	4				
IEBus controller		Effective transmission speed: 3.9 kbps/17 kbps/26 kbps				
A/D converter		<ul style="list-style-type: none">8-bit resolution \times 8 channelsOperate within wide power supply voltage range: $V_{DD} = 2.7$ to 6.0 V				
D/A converter		<ul style="list-style-type: none">8-bit resolution \times 2 channelsOperate within wide power supply voltage range: $V_{DD} = 2.7$ to 6.0 V				
Serial interface		<ul style="list-style-type: none">3-wire/SBI/2-wire mode : 1 channel3-wire mode (On-chip maximum 32-byte automatic transmit/receive function) : 1 channel3-wire/UART mode : 1 channel				
Timer		<ul style="list-style-type: none">16-bit timer/event counter : 1 channel8-bit timer/event counter : 2 channelsWatch timer : 1 channelWatchdog timer : 1 channel				
Timer output		3 (14-bit PWM output: 1)				
Clock output		15.6 kHz, 31.3 kHz, 62.5 kHz, 125 kHz, 250 kHz, 500 kHz, 1.0 MHz, 2.0 MHz, 4.0 MHz (@ main system clock of 6.0 MHz) 32.768 kHz (@ subsystem clock of 32.768 kHz)				
Buzzer output		977 Hz, 1.95 kHz, 3.9 kHz, 7.8 kHz (@ main system clock of 6.0 MHz)				
Vectored interrupt		23				
	Maskable	Internal: 14, External: 7				
	Nonmaskable	Internal: 1				
	Software	Internal: 1				
Test input		Internal: 1, External: 1				
Operating power supply voltage		$V_{DD} = 2.7$ to 6.0 V				
Operating ambient temperature		-40 to +85°C				
Package		<ul style="list-style-type: none">80-pin plastic QFP (14 \times 14 mm)80-pin ceramic WQFN (14 \times 14 mm): μPD78P098A only				

78K/0 Series (10/12)

Function		Part number	μ PD78001BY	μ PD78002BY	μ PD78P014Y
In full production/ under development			In full production		
Basic instruction			61		
Internal memory	ROM		8 K bytes (Mask ROM)	16 K bytes (Mask ROM)	32 K bytes (PROM)
	Internal high-speed RAM		256 bytes	384 bytes	1024 bytes
	Buffer RAM		None		32 bytes
Memory space			64 K bytes		
General register			8 bits \times 32 registers (8 bits \times 8 registers \times 4 banks)		
Instruction cycle			On-chip variable function for instruction execution time		
	Main system clock selection		0.4 μ s/0.8 μ s/1.6 μ s/3.2 μ s/6.4 μ s (@ 10 MHz)		
	Subsystem clock selection		122 μ s (@ 32.768 kHz)		
I/O port			53		
	CMOS input		2		
	CMOS I/O		47 (able to set an on-chip pull-up resistor to ON/OFF through the software)		
	N-ch open drain I/O (withstand voltage: 15 V)		4 (Pull-up resistor can be specified by mask option only for mask products)		
Serial interface			<ul style="list-style-type: none"> 3-wire/SBI/2-wire/I²C bus mode 		
Timer			<ul style="list-style-type: none"> 8-bit timer/event counter: 2 channels Watch timer: 1 channel Watchdog timer: 1 channel 		
Timer output			2		
Clock output			39.1 kHz, 78.1 kHz, 156 kHz, 313 kHz, 625 kHz, 1.25 MHz (@ main system clock of 10 MHz) 32.768 kHz (@ subsystem clock of 32.768 kHz)		
Buzzer output			2.4 kHz, 4.9 kHz, 9.8 kHz (@ main system clock of 10 MHz)		
Vectored interrupt			11		
	Maskable		Internal: 5, External: 4		
	Nonmaskable		Internal: 1		
	Software		Internal: 1		
Test input			Internal: 1, External: 1		
Operating power supply voltage			$V_{DD} = 2.7$ to 6.0 V		
Operating ambient temperature			-40 to +85 °C		
Package			<ul style="list-style-type: none"> 64-pin plastic shrink DIP (750 mil) 64-pin plastic QFP (14 \times 14 mm) 64-pin ceramic shrink DIP with window (750 mil): μPD78P014Y only 		

78K/0 Series (11/12)

Part number		μ PD78011BY	μ PD78012BY	μ PD78013Y	μ PD78014Y	μ PD78P014Y
Function						
In full production/ under development		In full production				
Basic instruction		63				
Internal memory	ROM	8 K bytes (Mask ROM)	16 K bytes (Mask ROM)	24 K bytes (Mask ROM)	32 K bytes (Mask ROM)	32 K bytes (PROM)
	Internal high-speed RAM	512 bytes			1024 bytes	
	Buffer RAM	32 bytes				
Memory space		64 K bytes				
General register		8 bits \times 32 registers (8 bits \times 8 registers \times 4 banks)				
Instruction cycle		On-chip variable function for instruction execution time				
	Main system clock selection	0.4 μ s/0.8 μ s/1.6 μ s/3.2 μ s/6.4 μ s (@ 10.0 MHz)				
	Subsystem clock selection	122 μ s (@ 32.768 kHz)				
I/O port		53				
	CMOS input	2				
	CMOS I/O	47 (able to set an on-chip pull-up resistor to ON/OFF through the software)				
	N-ch open drain I/O (withstand voltage: 15 V)	4 (Pull-up resistor can be specified by mask option only for mask products)				
A/D converter		<ul style="list-style-type: none">• 8-bit resolution \times 8 channels• Operate within wide power supply voltage range: $V_{DD} = 2.7$ to 6.0 V				
Serial interface		<ul style="list-style-type: none">• 3-wire/SBI/2-wire/I²C bus mode: 1 channel• 3-wire mode (On-chip maximum 32-byte automatic transmit/receive function) : 1 channel				
Timer		<ul style="list-style-type: none">• 16-bit timer/event counter : 1 channel• 8-bit timer/event counter : 2 channels• Watch timer : 1 channel• Watchdog timer : 1 channel				
Timer output		3 (14-bit PWM output: 1)				
Clock output		39.1 kHz, 78.1 kHz, 156 kHz, 313 kHz, 625 kHz, 1.25 MHz (@ main system clock of 10.0 MHz) 32.768 kHz (@ subsystem clock of 32.768 kHz)				
Buzzer output		2.4 kHz, 4.9 kHz, 9.8 kHz (@ main system clock of 10.0 MHz)				
Vectored interrupt		14				
	Maskable	Internal: 8, External: 4				
	Nonmaskable	Internal: 1				
	Software	Internal: 1				
Test input		Internal: 1, External: 1				
Operating power supply voltage		$V_{DD} = 2.7$ to 6.0 V				
Operating ambient temperature		-40 to +85 °C				
Package		<ul style="list-style-type: none">• 64-pin plastic shrink DIP (750 mil)• 64-pin plastic QFP (14 \times 14 mm)• 64-pin ceramic shrink DIP with window (750 mil): μPD78P014Y only				

78K/0 Series (12/12)

Function		Part number							
		μ PD78052Y	μ PD78053Y	μ PD78054Y	μ PD78P054Y	μ PD78055Y	μ PD78056Y	μ PD78058Y	μ PD78P058Y
In full production/ under development		In full production			Under development	In full production		Under development	
Basic instruction		63							
Internal memory	ROM	16 K bytes (Mask ROM)	24 K bytes (Mask ROM)	32 K bytes (Mask ROM)	32 K bytes (PROM)	40 K bytes (Mask ROM)	48 K bytes (Mask ROM)	60 K bytes (Mask ROM)	60 K bytes (PROM)
	Internal high-speed RAM	512 bytes	1024 bytes						
	Buffer RAM	32 bytes							
	Internal extension RAM	None							1024 bytes
Memory space		64 K bytes							
General register		8 bits \times 32 registers (8 bits \times 8 registers \times 4 banks)							
Instruction cycle		On-chip variable function for instruction execution time							
	Main system clock selection	0.4 μ s/0.8 μ s/1.6 μ s/3.2 μ s/6.4 μ s/12.8 μ s (@ 5.0 MHz)							
	Subsystem clock selection	122 μ s (@ 32.768 kHz)							
I/O port		69							
	CMOS input	2							
	CMOS I/O	63							
	N-ch open drain I/O	4							
A/D converter		<ul style="list-style-type: none">8-bit resolution \times 8 channelsOperate within wide power supply voltage range: $V_{DD} = 2.0$ to 6.0 V							
D/A converter		<ul style="list-style-type: none">8-bit resolution \times 2 channelsOperate within wide power supply voltage range: $V_{DD} = 2.0$ to 6.0 V							
Serial interface		<ul style="list-style-type: none">3-wire/2-wire/I²C bus mode : 1 channel3-wire mode (On-chip maximum 32-byte automatic transmit/receive function) : 1 channel3-wire/UART mode : 1 channel							
Timer		<ul style="list-style-type: none">16-bit timer/event counter : 1 channel8-bit timer/event counter : 2 channelsWatch timer : 1 channelWatchdog timer : 1 channel							
Timer output		3 (14-bit PWM output: 1)							
Clock output		19.5 kHz, 39.1 kHz, 78.1 kHz, 156 kHz, 313 kHz, 625 kHz, 1.25 MHz, 2.5 MHz, 5.0 MHz (@ main system clock of 5.0 MHz) 32.768 kHz (@ subsystem clock of 32.768 kHz)							
Buzzer output		1.2 kHz, 2.4 kHz, 4.9 kHz, 9.8 kHz (@ main system clock of 5.0 MHz)							
Vectored interrupt		22							
	Maskable	Internal: 13, External: 7							
	Nonmaskable	Internal: 1							
	Software	Internal: 1							
Test input		Internal: 1, External: 1							
Operating power supply voltage		$V_{DD} = 2.0$ to 6.0 V							
Operating ambient temperature		-40 to +85 $^{\circ}$ C							
Package		<ul style="list-style-type: none">80-pin plastic QFP (14 \times 14 mm)80-pin ceramic WQFN (14 \times 14 mm): μPD78P054Y, 78P058Y only							

78K/I Series (1/2)

Function		Part number	μ PD78134	μ PD78134A	μ PD78136	μ PD78138	μ PD78P138
In full production/ under development			In full production				
Basic instruction			63	64			
Minimum instruction execution time			0.33 μ s (@ 12 MHz)				
ROM (byte)			16384 (Mask ROM)	24576 (Mask ROM)	32768 (Mask ROM)	32768 (PROM)	
RAM (byte)			384	640			
Address space			Program, data: 64 K bytes				
Memory expansion			Externally expandable up to 64 K bytes max.				
General register			8 bits \times 8 \times 4 banks (memory mapped)				
Input/output port	Total	58 + 8 A/Ds					
	Input	12					
	Output	12					
	I/O	34					
Real-time output port			4 bits \times 2, or 8 bits \times 1				
A/D converter input			8-bit resolution \times 8 channels				
On-chip pull-up resistor			44 (software specifiable)				
Interrupt			<ul style="list-style-type: none">• 2-level programmable priority• Macro service				
	Total	17					
	External	5					
	Internal	12					
Timer/counter			<ul style="list-style-type: none">• 16-bit timer \times 3• 7-bit timer \times 1• 18-bit counter \times 1• Capture register \times 6• Compare register \times 7				
PWM output			Two 12-bit resolution				
	Carrier frequency	23.4 kHz	23.4 kHz/46.9 kHz switchable				
Serial interface			CSI \times 1 <ul style="list-style-type: none">• Channel 0 (3-wire serial I/O, SBI)				
Standby			STOP mode				
Operating power supply voltage			5 V \pm 10 %				
Package			<ul style="list-style-type: none">• 80-pin plastic QFP (14 \times 20 mm)				<ul style="list-style-type: none">• 80-pin ceramic WQFN (14 \times 20 mm)

78K/I Series (2/2)

Function		Part number	μ PD78146	μ PD78148	μ PD78P148
In full production/ under development			In full production		
Basic instruction			64		
Minimum instruction execution time			0.33 μ s (@ 12 MHz)		
ROM (byte)			24576 (Mask ROM)	32768 (Mask ROM)	32768 (PROM)
RAM (byte)			688	816	
General register			8 bits \times 8 \times 4 banks (memory mapped)		
Input/output port	Total	76 + 8 A/Ds + 1 timer output			
	Input	24			
	Output	12			
	I/O	40			
Real-time output port			18		
A/D converter input			8-bit resolution \times 15 channels		
On-chip pull-up resistor			48 (software specifiable)		
Interrupt			<ul style="list-style-type: none">• 2-level programmable priority• Macro service		
	Total	25			
	External	5			
	Internal	20			
Timer/counter			<ul style="list-style-type: none">• 16-bit timer \times 3• 8-bit timer \times 3 (remote control reception function \times 1)• 22-bit counter \times 1• 6-bit counter \times 1• Capture register \times 7• Compare register \times 10• Watch timer \times 1		
PWM output			<ul style="list-style-type: none">• 12-bit resolution \times 2 (carrier frequency: 23.4 kHz/46.9 kHz switchable)• 8-bit resolution \times 3 (carrier frequency: 5.9 kHz)• 14-bit resolution \times 1 (carrier frequency: 5.9 kHz)		
Serial interface			CSI \times 2 <ul style="list-style-type: none">• Channel 0 (3-wire serial I/O, SBI)• Channel 1 (3-wire serial I/O with automatic transmit/receive function)		
Standby			HALT/STOP mode		
Operating power supply voltage			5 V \pm 10 %		
Package			<ul style="list-style-type: none">• 100-pin plastic QFP (14 \times 20 mm)		<ul style="list-style-type: none">• 100-pin ceramic WQFN (14 \times 20 mm)

78K/II Series (1/3)

Part number		μ PD78212	μ PD78213	μ PD78214	μ PD78P214	μ PD78217A	μ PD78218A	μ PD78P218A	
Function									
In full production/ under development		In full production							
Basic instruction		65							
Minimum instruction execution time		0.33 μ s (@ 12 MHz)	0.5 μ s (@ 12 MHz)	0.33 μ s (@ 12 MHz)		0.5 μ s (@ 12 MHz)	0.33 μ s (@ 12 MHz)		
ROM (byte)		8192 (Mask ROM)	ROM-less	16384 (Mask ROM)	16384 (PROM)	ROM-less	32768 (Mask ROM)	32768 (PROM)	
RAM (byte)		384	512			1024			
Address space		Program: 64 K bytes, data: 1 M bytes							
Memory expansion		Can be expanded externally up to 1 M bytes max.							
General register		8 bits \times 8 \times 4 banks (memory mapped)							
Pseudo-SRAM refresh function		Yes							
Input/output port	Total	54	36	54		36	54		
	Input	14							
	Output	12							
	I/O	28	10	28		10	28		
Real-time output port		4 bits \times 2, or 8 bits \times 1							
A/D converter input		8-bit resolution \times 8 channels (Also used for an input port)							
On-chip pull-up resistor		34	16	34		16	34		
Interrupt		<ul style="list-style-type: none">Macro service/vectored interrupt2-level programmable priority							
		Total	19+BRK instruction						
		External	7						
		Internal	12						
Timer/counter		<ul style="list-style-type: none">16-bit timer/counter \times 18-bit timer counter \times 3Capture register \times 2Compare register \times 6Capture/compare register \times 1 (PWM/PPG: 2 \times 2 channels possible)							
Serial interface		<ul style="list-style-type: none">UART (On-chip baud rate generator) \times 1CSI (3-wire serial I/O, SBI) \times 1							
Standby		HALT/STOP mode							
Operating power supply voltage		5 V \pm 10 %						5 V \pm 0.3 V	
Package		<ul style="list-style-type: none">64-pin plastic shrink DIP (750 mil)64-pin plastic QUIP^{Note}68-pin plastic QFJ (950 \times 950 mil)^{Note}64-pin plastic QFP (14 \times 14 mm)74-pin plastic QFP (20 \times 20 mm)		<ul style="list-style-type: none">64-pin ceramic shrink DIP with window (750 mil)		<ul style="list-style-type: none">64-pin plastic shrink DIP (750 mil)64-pin plastic QFP (14 \times 14 mm)		<ul style="list-style-type: none">64-pin ceramic shrink DIP with window (750 mil)	

Note Other than μ PD78212.

78K/II Series (2/3)

Function		Part number	μ PD78220	μ PD78224	μ PD78P224
In full production/ under development			In full production		
Basic instruction			65		
Minimum instruction execution time			0.5 μ s (@ 12 MHz)	0.33 μ s (@ 12 MHz)	
ROM (byte)			ROM-less	16384 (Mask ROM)	16384 (PROM)
RAM (byte)			640		
Address space			Program: 64 K bytes, data: 1 M bytes		
Memory expansion			Externally expandable up to 1 M bytes max.		
General register			8 bits \times 8 \times 4 banks (memory mapped)		
Pseudo-SRAM refresh function			Yes		
Input/output port	Total	45 + 8 comparators	63 + 8 comparators		
	Input	8			
	Output	12	20		
	I/O	25	35		
Real-time output port			4 bits \times 2, or 8 bits \times 1		
Comparator input			4 bits \times 8 (4-bit program control flexible threshold)		
Interrupt			• Macro service/vectored interrupt • 2-level programmable priority		
	Total	17			
	External	8			
	Internal	9			
Timer/counter			• 16-bit timer/counter \times 1 • 8-bit timer/counter \times 2 • Capture register \times 2 • Compare register \times 5 • Capture/compare register \times 1		
Serial interface			• UART \times 1 • CSI (3-wire serial I/O, SBI) \times 1		
Standby			HALT/STOP mode		
Operating power supply voltage			5 V \pm 10 %		
Package			• 84-pin plastic QFJ (1150 \times 1150 mil) • 94-pin plastic QFP (20 \times 20 mm)		

78K/II Series (3/3)

Function		Part number						
		μ PD78233	μ PD78234	μ PD78237	μ PD78238	μ PD78P238	μ PD78243	μ PD78244
In full production/ under development		In full production						
Basic instruction		65						
Minimum instruction execution time		0.5 μ s (@ 12 MHz)	0.33 μ s (@ 12 MHz)	0.5 μ s (@ 12 MHz)	0.33 μ s (@ 12 MHz)		0.5 μ s (@ 12 MHz)	0.33 μ s (@ 12 MHz)
ROM (byte)		ROM-less	16384 (Mask ROM)	ROM-less	32768 (Mask ROM)	32768/ 16384 ^{Note} (PROM)	ROM-less	16384 (Mask ROM)
RAM (byte)		640		1024		1024/640 ^{Note}	512	
EEPROM (byte)		None					512	
Address space		Program: 64 K bytes, data: 1 M bytes						
Memory expansion		Can be expanded externally up to 1 M bytes max.						
General register		8 bits \times 8 \times 4 banks (memory mapped)						
Pseudo-SRAM refresh function		Yes						
Input/output port	Total	46	64	46	64		36	54
	Input	16					14	
	Output	12						
	I/O	18	36	18	36		10	28
Real-time output port		4 bits \times 2, or 8 bits \times 1						
A/D converter input		8-bit resolution \times 8 channels (Also used for an input port)						
D/A converter output		8-bit resolution \times 2 channels					None	
On-chip pull-up resistor		24	42	24	42		16	34
*Interrupt		<ul style="list-style-type: none">• Macro service/vectored interrupt• 2-level programmable priority						
	Total	19 + 1 BRK					21 + 1 BRK	
	External	7						
	Internal	12					14	
Timer/counter		<ul style="list-style-type: none">• 12-bit PWM \times 2• 16-bit timer/counter \times 1• 8-bit timer/counter \times 3• Capture register \times 2• Compare register \times 6• Capture/compare register \times 1 (PWM/PPG: 2 \times 2 channels)						
Serial interface		<ul style="list-style-type: none">• UART (On-chip baud rate generator) \times 1• CSI (3-wire serial I/O, SBI) \times 1						
Standby		STOP/HALT mode						
Operating power supply voltage		5 V \pm 10 %						
Package		<ul style="list-style-type: none">• 84-pin plastic QFJ (1150 \times 1150 mil)• 80-pin plastic QFP (14 \times 14 mm)• 94-pin plastic QFP (20 \times 20 mm)				<ul style="list-style-type: none">• 94-pin ceramic WQFN (20 \times 20 mm)	<ul style="list-style-type: none">• 64-pin plastic shrink DIP (750 mil)• 64-pin plastic QFP (14 \times 14 mm)	

Note Set by software.

78K/III Series (1/7)

Function		Part number	μ PD78310A	μ PD78312A	μ PD78P312A
In full production/ under development			In full production		
Basic instruction			96		
Minimum instruction execution time			0.5 μ s (@ 12 MHz)		
ROM (byte)			ROM-less	8192 (Mask ROM)	8192 (PROM)
RAM (byte)			256		
Address space			Program, data: 64 K bytes		
Memory expansion			Externally expandable up to 64 K bytes max.		
General register			8 bits \times 16 \times 8 banks (memory mapped)		
Pseudo-SRAM refresh function			Yes		
Input/output port	Total	32	48		
	Input	8			
	Output	None			
	I/O	24	40		
Real-time output port			4 bits \times 2		
A/D converter input			8-bit resolution \times 4 channels		
Interrupt			• Macro service/vectored interrupt/context switching		
			• 8-level programmable priority		
			Total	17	
			External	4	
			Internal	13	
Timer/counter			• 16-bit presetable up/down-counter \times 2		
			• 16-bit interval timer \times 2		
			• 16-bit free running counter \times 1		
			• High resolution PWM output \times 2		
			• Timer output \times 2		
Auxiliary register			• Capture register \times 2		
			• Capture/compare register \times 4		
Watchdog timer			Yes		
Serial interface			• UART (On-chip baud rate generator) \times 1		
			• CSI (3-wire serial I/O, SBI) \times 1		
Standby			HALT/STOP mode		
Operating power supply voltage			5 V \pm 10 %		
Package			• 64-pin plastic shrink DIP (750 mil)		
			• 64-pin plastic QUIP		
			• 64-pin plastic QFP (14 \times 20 mm)		
			• 68-pin plastic QFJ (950 \times 950 mil)		
			• 64-pin shrink DIP with window (750 mil)		
			• 64-pin ceramic QUIP with window		

78K/III Series (2/7)

Part number		μ PD78320	μ PD78322	μ PD78P322	μ PD78323	μ PD78324	μ PD78P324
Function							
In full production/ under development		In full production					
Basic instruction		111					
Minimum instruction execution time		0.25 μ s (@ 16 MHz)					
ROM (byte)		ROM-less	16384 (Mask ROM)	16384 (PROM)	ROM-less	32768 (Mask ROM)	32768 (PROM)
RAM (byte)		640			1024		
Address space		Program, data: 64 K bytes					
Memory expansion		Externally expandable up to 64 K bytes max.					
General register		8 bits \times 16 \times 8 banks (memory mapped)					
Turbo access manager control signal output		Yes					
Input/output port	Total	37	55		37	55	
	Input	16					
	Output	None					
	I/O	21	39		21	39	
Real-time output port		8 bits \times 1					
A/D converter input		10-bit resolution \times 8 channels (Also used for a port)					
Interrupt		• Macro service/vectored interrupt/context switching					
		• 3-level programmable priority					
		Total	20				
		External	8				
		Internal	14 (Two of them are also used for external interrupt.)				
Test factor		Internal: 1					
Timer/counter		• 16/18-bit free running counter \times 1					
		• 16-bit timer/event counter \times 1					
		Pulse output	6				
		Auxiliary register	• 16-bit compare register \times 6 • 18-bit capture register \times 4 • 18-bit capture/compare register \times 2				
Watchdog timer		Yes					
Serial interface		• UART (On-chip baud rate generator) \times 1 • CSI (3-wire serial I/O, SBI) \times 1					
Standby		HALT/STOP mode					
Operating power supply voltage		5 V \pm 10 %		5 V \pm 5 %	5 V \pm 10 %		
Others							• On-chip ECC circuit
Package		• 74-pin plastic QFP (20 \times 20 mm) • 80-pin plastic QFP (14 \times 20 mm) • 68-pin plastic QFJ (950 \times 950 mil)		• 68-pin ceramic WQFN • 74-pin ceramic WQFN (20 \times 20 mm) • 80-pin ceramic WQFN (14 \times 20 mm)	• 74-pin plastic QFP (20 \times 20 mm) • 68-pin plastic QFJ (950 \times 950 mil)		• 68-pin ceramic WQFN • 74-pin ceramic WQFN (20 \times 20 mm)

78K/III Series (3/7)

Function		Part number		μ PD78327	μ PD78328	μ PD78P328	μ PD78330	μ PD78334	μ PD78P334
In full production/ under development		In full production							
Basic instruction		111							
Minimum instruction execution time		0.25 μ s (@ 16 MHz)							
ROM (byte)		ROM-less	16384 (Mask ROM)	16384 (PROM)	ROM-less	32768 (Mask ROM)	32768 (PROM)		
RAM (byte)		512				1024			
Address space		Program, data: 64 K bytes							
Memory expansion		Externally expandable up to 64 K bytes max.							
General register		8 bits \times 16 \times 8 banks (memory mapped)							
Turbo access manager control signal output		Yes				None			
Input/output port	Total	34	52				70		
	Input	11				24			
	Output	None							
	I/O	23	41				28	46	
Real-time output port		4 bits \times 2, or 8 bits \times 1				8 bits \times 1			
A/D converter input		10-bit resolution \times 8 channels (Also used for a port)				10-bit resolution \times 16 channels (Also used for a port)			
Interrupt		<ul style="list-style-type: none">Macro service/vectored interrupt/context switching3-level programmable priority							
		Total	20				20		
		External	4				8		
		Internal	16				14 (Two of them are also used for external interrupt.)		
Test factor		Internal: 1							
Timer/counter		<ul style="list-style-type: none">16-bit timer \times 216-bit timer/counter \times 1				<ul style="list-style-type: none">18/16-bit timer/counter \times 116-bit timer/counter \times 3			
	Auxiliary register	<ul style="list-style-type: none">16-bit capture/compare register \times 116-bit compare register \times 14				<ul style="list-style-type: none">18/16-bit compare register \times 518/16-bit capture register \times 318/16-bit capture/compare register \times 216-bit compare register \times 516-bit capture register \times 1			
	Pulse output	8 8-bit PWM \times 1				11			
Watchdog timer		Yes							
Serial interface		<ul style="list-style-type: none">UART (On-chip baud rate generator) \times 1CSI (3-wire serial I/O, SBI) \times 1							
Standby		HALT/STOP mode							
Operating power supply voltage		5 V \pm 10 %		5 V \pm 5 %		5 V \pm 10 %			
Others									<ul style="list-style-type: none">On-chip ECC circuit
Package		<ul style="list-style-type: none">64-pin plastic shrink DIP (750 mil)64-pin plastic QFP (14 \times 20 mm)		<ul style="list-style-type: none">64-pin ceramic shrink DIP with window (750 mil)		<ul style="list-style-type: none">94-pin plastic QFP (20 \times 20 mm)84-pin plastic QFJ (1150 \times 1150 mil)		<ul style="list-style-type: none">84-pin ceramic WQFN94-pin ceramic WQFN (20 \times 20 mm)	

78K/III Series (4/7)

Function		Part number	μ PD78350	μ PD78350A	μ PD78352A	μ PD78P352
In full production/ under development			In full production			
Basic instruction			113			
Minimum instruction execution time			0.16 μ s (@ 25 MHz)		0.125 μ s (@ 32 MHz)	
ROM (byte)			ROM-less		32768 (Mask ROM)	32768 (PROM)
RAM (byte)			640			
Address space			Program, data: 64 K bytes			
Memory expansion			Externally expandable up to 64 K bytes max.			
General register			8 bits \times 16 \times 8 banks (memory mapped)			
Input/output port	Total	30		50		
	Input	6				
	Output	None				
	I/O	24		44		
Real-time output port			None			
A/D converter input			None			
D/A converter output			None			
On-chip pull-up resistor			None			
Interrupt			<ul style="list-style-type: none">• Vectored interrupt/macro service/context switching• 4-level programmable priority			
	Total	9				
	External	5				
	Internal	4				
Timer/counter			<ul style="list-style-type: none">• 16-bit timer \times 3			
	Auxiliary register	<ul style="list-style-type: none">• 16-bit compare register \times 2• 16-bit capture register \times 2				
	Pulse output	None				
Dedicated PWM output			8-bit resolution \times 2 channels			
Watchdog timer			Yes			
Serial interface			None			
Standby			HALT/STOP mode			
Operating power supply voltage			5 V \pm 10 %			
Others			Sum-of-products operation instruction			
Package			<ul style="list-style-type: none">• 64-pin plastic QFP (14 \times 14 mm)			<ul style="list-style-type: none">• 64-pin ceramic WQFN (14 \times 14 mm)^{Note}

Note Under development

78K/III Series (5/7)

Function		Part number		μ PD78355	μ PD78356	μ PD78P356
In full production/ under development		Under development				
Basic instruction		115				
Minimum instruction execution time		0.125 μ s (@ 32 MHz)				
ROM (byte)		ROM-less		49152 (Mask ROM)	49152 (PROM)	
RAM (byte)		2048				
Address space		Program, data: 64 K bytes				
Memory expansion		Externally expandable up to 64 K bytes max.				
General register		8 bits \times 16 \times 8 banks (memory mapped)				
Input/output port	Total	57		76		
	Input	9				
	Output	None				
	I/O	48		67		
Real-time output port		Pulse output linked with real-time pulse unit: 8 bits \times 1				
A/D converter input		10-bit resolution \times 8 channels (Also used for a port)				
D/A converter output		8-bit resolution \times 2 channels				
On-chip pull-up resistor		48		67		
Interrupt		<ul style="list-style-type: none">• Vectored interrupt/macro service/context switching• 4-level programmable priority				
	Total	26				
	External	6				
	Internal	25 (Five of them are also used for external interrupt.)				
Timer/counter		<ul style="list-style-type: none">• 16-bit timer \times 5• 10-bit timer \times 1				
	Auxiliary register	<ul style="list-style-type: none">• 16-bit compare register \times 10• 10-bit compare register \times 1• 16-bit capture/compare register \times 5				
	Pulse output	10				
Dedicated PWM output		8-/10-/12-bit resolution \times 2 channels				
Watchdog timer		Yes				
Serial interface		<ul style="list-style-type: none">• UART (On-chip baud rate generator) \times 1• CSI \times 23-wire serial I/O, SBI \times 13-wire serial I/O \times 1 (with pin switching function)				
Standby		HALT/STOP mode				
Operating power supply voltage		Undefined				
Others		Sum-of-products operation instruction/ correlation operation instruction				On-chip ECC circuit
Package		<ul style="list-style-type: none">• 100-pin plastic QFP (14 \times 14 mm)• 120-pin plastic QFP (28 \times 28 mm)				<ul style="list-style-type: none">• 120-pin ceramic WQFN (28 \times 28 mm)

78K/III Series (6/7)

Part number		μ PD78365	μ PD78366	μ PD78P368
Function				
In full production/ under development		Under development		
Basic instruction		115		
Minimum instruction execution time		0.125 μ s (Internal: @16 MHz)		
ROM (byte)		ROM-less	32768 (Mask ROM)	49152 (PROM)
RAM (byte)		2048		
Address space		Program, data: 64 K bytes		
Memory expansion		Externally expandable up to 64 K bytes max.		
General register		8 bits \times 16 \times 8 banks (memory mapped)		
Input/output port	Total	45	63	
	Input	14		
	Output	None		
	I/O	31	49	
Real-time output port		Pulse output linked with real-time pulse unit: 4 bits \times 1		
A/D converter input		10-bit resolution \times 8 channels		
Interrupt		<ul style="list-style-type: none">• Vectored interrupt/macro service/context switching• 4-level programmable priority		
	Total	18		
	External	6		
	Internal	14 (Two of them are also used for external interrupt.)		
Timer/counter		<ul style="list-style-type: none">• 16-bit timer \times 5		
	Auxiliary register	<ul style="list-style-type: none">• 16-bit compare register \times 7• 16-bit capture/compare register \times 2• 16-bit capture register \times 3		
	Pulse output	7		
Dedicated PWM output		8-/9-/10-/12-bit resolution \times 2 channels		
Watchdog timer		Yes		
Serial interface		<ul style="list-style-type: none">• UART (On-chip baud rate generator) \times 1 (with pin switching function)• CSI (3-wire serial I/O, SBI) \times 1		
Standby		HALT/STOP mode		
Operating power supply voltage		Undefined		
Others		<ul style="list-style-type: none">• Sum-of-products operation instruction/correlation operation instruction• On-chip PLL circuit for clock generation (External 8-MHz \rightarrow Internal 16-MHz operation)		
Package		<ul style="list-style-type: none">• 80-pin plastic QFP (14 \times 20 mm)		<ul style="list-style-type: none">• 80-pin ceramic WQFN (14 \times 20 mm)

78K/III Series (7/7)

Function		Part number	μ PD78370	μ PD78372	μ PD78P372
In full production/ under development			Under development		
Basic instruction			115		
Minimum instruction execution time			0.125 μ s (@ 32 MHz)		
ROM (byte)			ROM-less	24576 (Mask ROM)	24576 (PROM)
RAM (byte)			768		
Address space			Program, data: 64 K bytes		
Memory expansion			Externally expandable up to 64 K bytes max.		
General register			8 bits \times 16 \times 8 banks (memory mapped)		
Input/output port	Total	41	60		
	Input	17			
	Output	None			
	I/O	24	43		
Real-time output port			None		
A/D converter input			10-bit resolution \times 16 channels		
D/A converter output			None		
On-chip pull-up resistor			25	44	
Interrupt			<ul style="list-style-type: none">• Vectored interrupt/macro service/context switching• 4-level programmable priority		
	Total	23			
	External	11			
	Internal	18 (Six of them are also used for external interrupt.)			
Timer/counter			<ul style="list-style-type: none">• 18-/16-bit timer \times 1• 16-bit timer \times 1		
	Auxiliary register	<ul style="list-style-type: none">• 18-/16-bit capture/compare register \times 6• 16-bit compare register \times 4			
	Pulse output	10			
Dedicated PWM output			None		
Watchdog timer			Yes		
Serial interface			<ul style="list-style-type: none">• UART (On-chip baud rate generator) \times 1• CSI (3-wire serial I/O) \times 1		
Standby			HALT/STOP mode, standby function invalid mode		
Operating power supply voltage			Undefined		
Others			Sum-of-products operation instruction/ correlation operation instruction		On-chip ECC circuit
Package			• 80-pin plastic QFP (14 \times 20 mm)		• 80-pin ceramic WQFN (14 \times 20 mm)

78K/IV Series (78K/II+subseries)

Part number		μ PD784020	μ PD784021	μ PD784025	μ PD784026	μ PD78P4026
Function						
In full production/ under development		Under development				
Basic instructions (mnemonic)		113				
General register		8-bit \times 16 \times 8 banks, or 16-bit \times 8 \times 8 banks (memory mapped)				
Minimum instruction execution time		160 ns/320 ns/640 ns/1280 ns (@ 25 MHz)				
On-chip memory capacity	ROM	None		48 K bytes (Mask ROM)	64 K bytes (Mask ROM)	64 K bytes (PROM)
	RAM	512 bytes	2048 bytes			
Memory space	Program	1M bytes total				
	Data					
I/O pin	Total	46		64		
	Input	8		8		
	I/O	34		56		
	Output	4		0		
Pin with added function ^{Note}	Pin with pull-up resistor	32		54		
	LED direct drive output	8		24		
	Transistor direct drive	8				
Real-time output port		4 bits \times 2, or 8 bits \times 1				
Timer/counter	16-bit timer/counter 0	timer/register \times 1 compare register \times 2 capture register \times 1			pulse output available [toggle output PWM/PPG output one-shot pulse output]	
	16-bit timer/counter 1	timer/register \times 1 compare register \times 1 capture register \times 1 capture/compare register \times 1			pulse output available (real-time output: 4 bits \times 2)	
	16-bit timer/counter 2	timer/register \times 1 compare register \times 1 capture/compare register \times 1 capture register \times 1			pulse output available [toggle output PWM/PPG output]	
	16-bit timer/counter 3	timer/register \times 1 compare register \times 1				
PWM output function		12-bit resolution \times 2 channels				
Serial interface		• UART \times IOE (3-wire serial I/O): 2 channels (On-chip baud rate generator) • CSI (3-wire serial I/O, SBI) : 1 channel				
A/D converter		8-bit resolution \times 8 channels				
D/A converter		8-bit resolution \times 2 channels				
Watchdog timer		1 channel				
Interrupt		23 factors (7 external factors (variable sampling clock input: 1), 16 internal factors) 4-level programmable priority 3 modes of processing (macro service, vectored interrupt, context switch)				
Standby		HALT/STOP/IDLE mode				
Clock output		None		f _{clk} , f _{clk} /2, f _{clk} /4, f _{clk} /8, or f _{clk} /16 selectable (usable at 1-bit output port)		
Operating power supply voltage		2.7 V to 6.0 V				
Package		80-pin plastic QFP (14 \times 14 mm)				• 80-pin ceramic WQFN (14 \times 14 mm)

Note The pin with added function is included in the I/O pin.

Part number	78K1V0000	78K1V0001	78K1V0002	78K1V0003	78K1V0004
Function	Under development				
Basic instructions (in product)	113				
General register	8-bit x 16 x 8 bank, or 16-bit x 8 x 8 bank (memory mapped)				
Minimum instruction execution time	100 nsec (10 MHz) / 150 nsec (7.5 MHz)				
On-chip memory capacity	ROM	None			
	RAM	512 bytes			
Memory access	Program	1M bytes total			
	Data	1M bytes total			
IO pin	IO pin	40			
	IO pin	8			
	IO pin	32			
	IO pin	4			
	IO pin	0			
	IO pin	64			
Function (pin with address)	IO pin with address	32			
	IO pin with address	8			
Function (pin with address)	IO pin with address	32			
	IO pin with address	8			
Reset pin output	8				
Timer/counter	16-bit counter/16-bit timer	16-bit counter/16-bit timer			
	16-bit counter/16-bit timer	16-bit counter/16-bit timer			
	16-bit counter/16-bit timer	16-bit counter/16-bit timer			
	16-bit counter/16-bit timer	16-bit counter/16-bit timer			
Serial interface	UART x 1 (8-bit serial) / 1 channel	UART x 1 (8-bit serial) / 1 channel			
	UART x 1 (8-bit serial) / 1 channel	UART x 1 (8-bit serial) / 1 channel			
A/D converter	8-bit resolution x 8 channels	8-bit resolution x 8 channels			
D/A converter	8-bit resolution x 8 channels	8-bit resolution x 8 channels			
Watchdog timer	1 channel	1 channel			
Interrupt	32 sources (1 external factor) / 16-bit timer (internal)	32 sources (1 external factor) / 16-bit timer (internal)			
	4-level programmable priority	4-level programmable priority			
HALT/STOP mode	3 modes of processing (interrupt service, vector, interrupt control switch)	3 modes of processing (interrupt service, vector, interrupt control switch)			
	HALT/STOP mode	HALT/STOP mode			
Clock output	None	100 kHz, 1 MHz, 10 MHz, or 100 MHz selectable			
	None	100 kHz, 1 MHz, 10 MHz, or 100 MHz selectable			
Operating power supply voltage	2.5 V to 5.0 V				
Package	80-pin plastic DIP (14 x 14 mm)	80-pin plastic DIP (14 x 14 mm)			
	80-pin plastic DIP (14 x 14 mm)	80-pin plastic DIP (14 x 14 mm)			

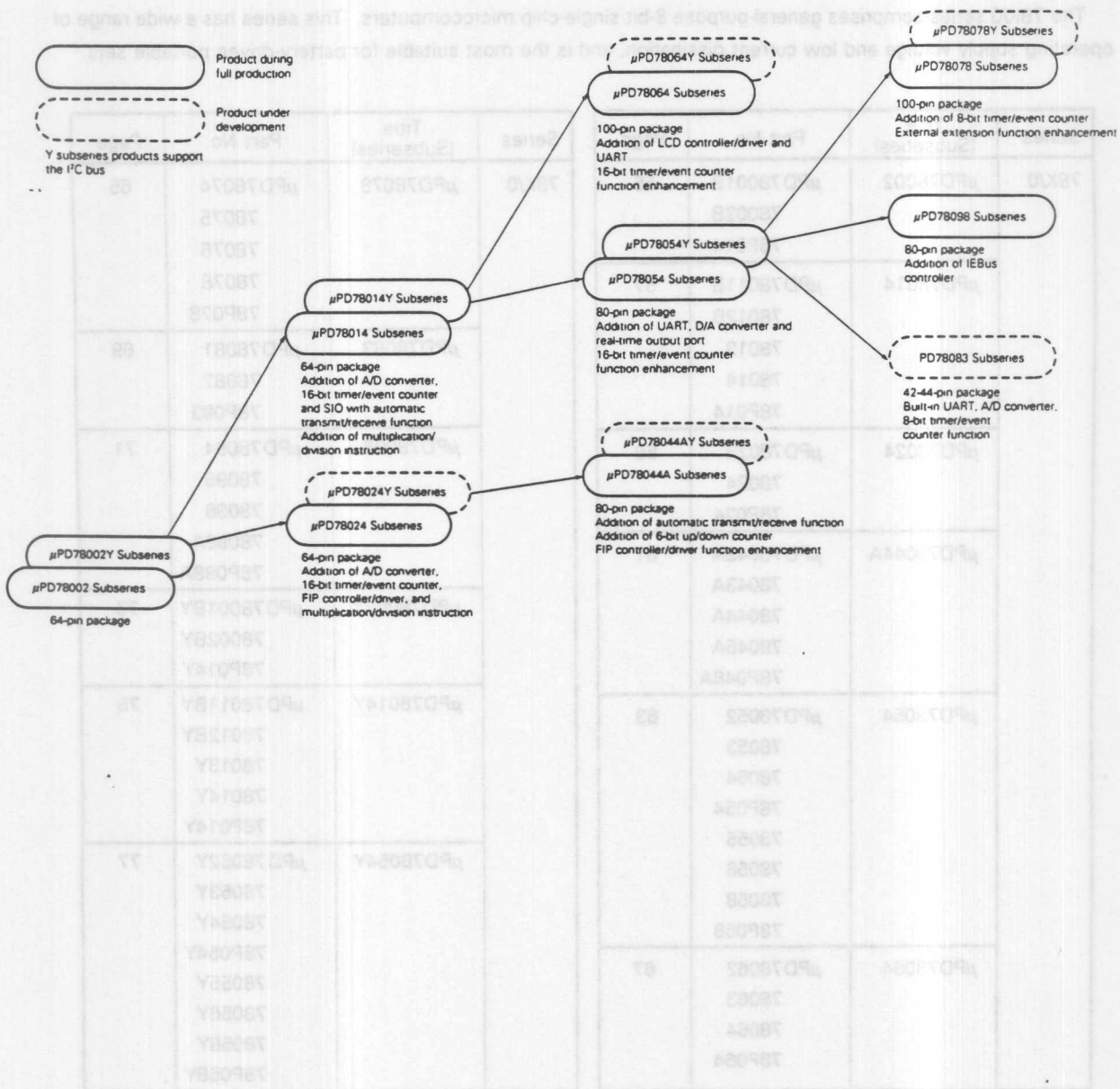
Note: The pin with address function is included in the IO pin.

4.3 78K/0 Series

The 78K/0 series comprises general-purpose 8-bit single-chip microcomputers. This series has a wide range of operating supply voltage and low current dissipation, and is the most suitable for battery-driven portable sets.

Series	Title (Subseries)	Part No.	Page	Series	Title (Subseries)	Part No.	Page
78K/0	μPD78002	μPD78001B	55	78K/0	μPD78078	μPD78074	65
		78002B				78075	
		78P014				78076	
	μPD78014	μPD78011B	78078				
		78012B	78P078				
		78013	μPD78083		μPD78081	69	
	78014	78082					
	78P014	78P083					
	μPD78024	μPD78023	59		μPD78098	μPD78094	71
	μPD78044A.	78024				78095	
		78P024				78096	
μPD78042A		78098A					
78043A	78P098A						
78044A	μPD78002Y	μPD78001BY	73				
78045A		78002BY					
78P048A		78P014Y					
μPD78054	μPD78052	63	μPD78014Y	μPD78011BY	75		
	78053			78012BY			
	78054			78013Y			
	78P054			78014Y			
	78055		μPD78054Y	μPD78052Y	77		
	78056					78P014Y	
	78058					78053Y	
	78P058					78054Y	
μPD78064	μPD78062	67		78P054Y			
	78063			78055Y			
	78064			78056Y			
	78P064			78058Y			
				78P058Y			

78K/0 Series Product Development



4.3.1 μ PD78002

General-Purpose Control Microcomputer

Products: μ PD78001B, 78002B, 78P014

The μ PD78002B is an 8-bit single-chip microcomputer belonging to the 78K/0 series.

The μ PD78002B has an on-chip high-speed and high-performance CPU as well as on-chip peripheral hardware including ROM, RAM, I/O ports, timer, serial interface and interrupt control. Bit processing is possible in the whole address space.

The μ PD78002B offers good cost performance, and is ideally suited for control applications for consumer products.

With the one-time PROM or EPROM on-chip products, the μ PD78P014, which can operate in the same range of power supply voltage as on-chip mask ROM products, is available. This product is powerful for application system development, early startup and limited production.

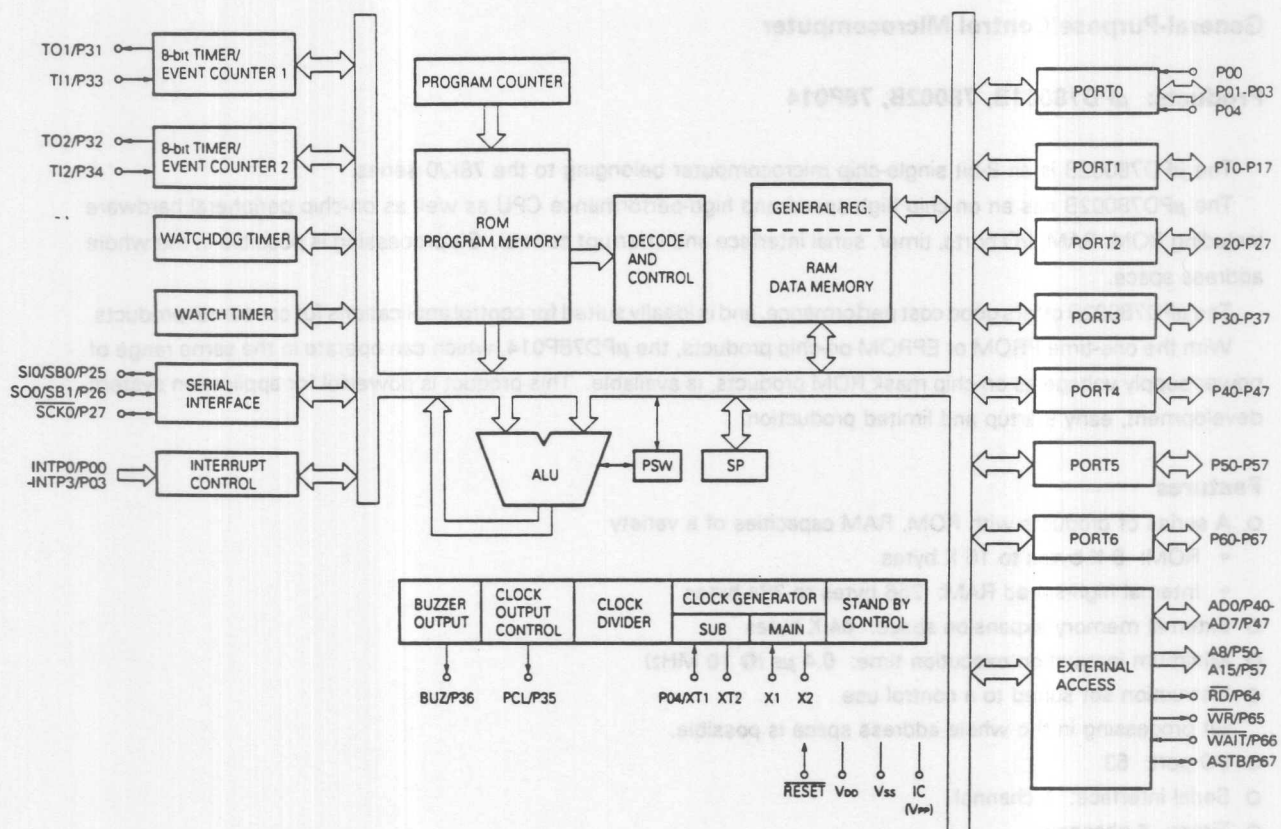
Features

- A series of products with ROM, RAM capacities of a variety
 - ROM: 8 K bytes to 16 K bytes
 - Internal high-speed RAM: 256 bytes to 384 bytes
- External memory expansion space: 64 K bytes
- Minimum instruction execution time: 0.4 μ s (@ 10 MHz)
- Instruction set suited to a control use
 - Bit processing in the whole address space is possible.
- I/O port: 53
- Serial interface: 1 channel
- Timer: 4 channels
- Vectored interrupt: 11 (external: 4, internal: 7)
- Test input: 2 (external: 1, internal: 1)
- On-chip clock subsystem clock oscillator
- Operating power supply voltage range: 2.7 to 6.0 V
- Low power dissipation
- Software can be developed by C compiler or structured assembler.

Application Field

Telephones, VCRs, audio equipment, cameras, home electric appliance, etc.

Block Diagram



- Remarks**
1. Internal ROM, RAM capacity depends on the product.
 2. IC for mask ROM. V_{PP} for the μPD78P014.

4.3.2 μ PD78014

Microcomputer for Control with On-Chip A/D Converter

Products: μ PD78011B, 78012B, 78013, 78014, 78P014

The μ PD78014 is an 8-bit single-chip microcomputer belonging to the 78K/0 series.

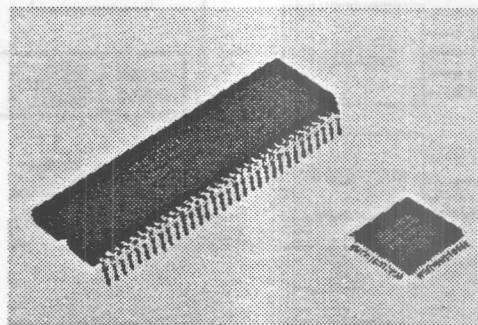
The μ PD78014 has an on-chip high-speed and high-performance CPU as well as various on-chip peripheral hardware including ROM, RAM, I/O ports, 8-bit resolution A/D converter, timer, serial interface and interrupt control, and is ideally suited for consumer product applications.

The μ PD78P014 one-time PROM product or EPROM product, which can operate in the same range of power supply voltage as mask ROM, is available. This product is powerful for application system development, early startup and limited production.

Additionally, various development tools (IE-78000-R, assembler, etc.) are available.

Features

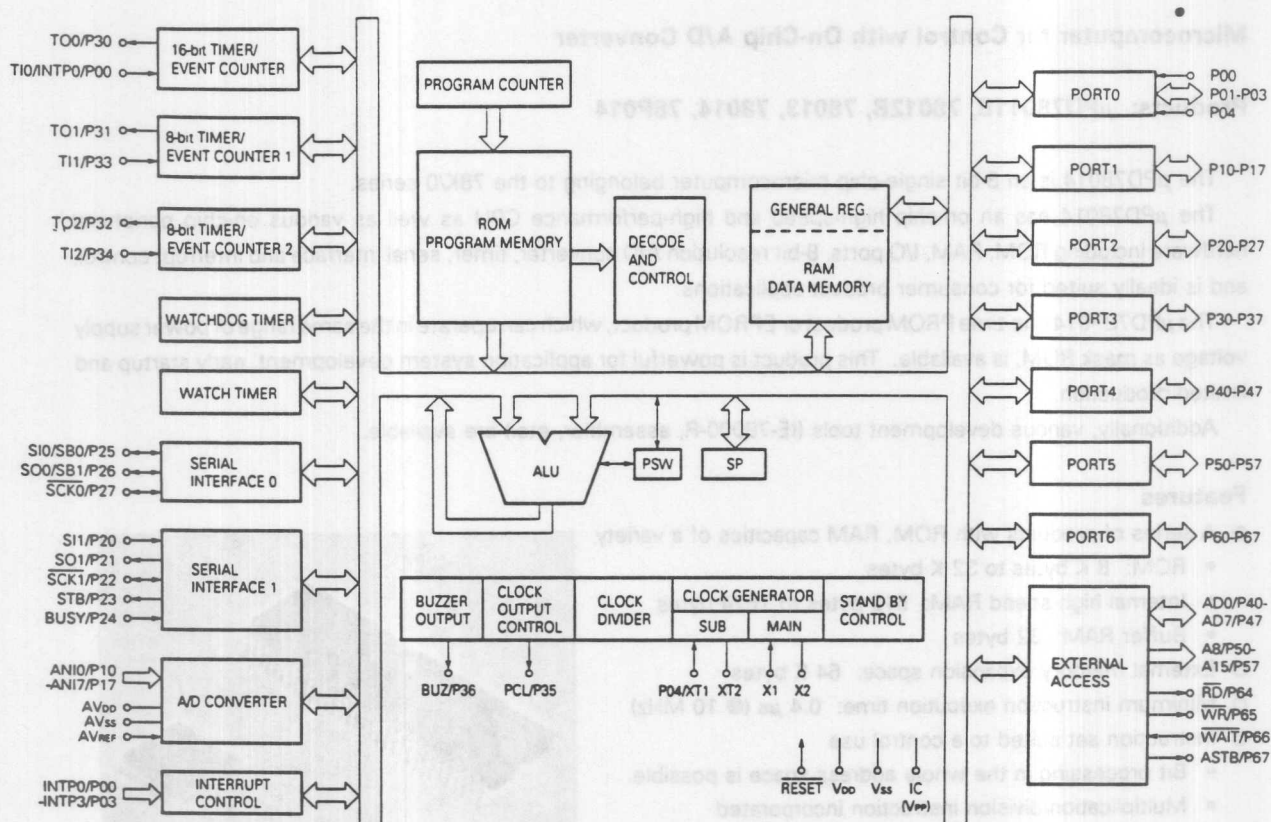
- A series of products with ROM, RAM capacities of a variety
 - ROM: 8 K bytes to 32 K bytes
 - Internal high-speed RAM: 512 bytes to 1024 bytes
 - Buffer RAM: 32 bytes
- External memory expansion space: 64 K bytes
- Minimum instruction execution time: 0.4 μ s (@ 10 MHz)
- Instruction set suited to a control use
 - Bit processing in the whole address space is possible.
 - Multiplication/division instruction incorporated
- I/O port: 53
- 8-bit resolution A/D converter: 8 channels
- Serial interface: 2 channels
 - On-chip maximum 32-byte data automatic transmit/receive function
- Timer: 5 channels
- Vectored interrupt: 14 (external: 4, internal: 10)
- Test input: 2 (external: 1, internal: 1)
- On-chip clock subsystem clock oscillator
- Operating power supply voltage range: 2.7 to 6.0 V
- Software can be developed by C compiler or structured assembler.



Application Field

Telephones, VCRs, audio equipment, cameras, home electric appliance, etc.

Block Diagram



- Remarks**
1. Internal ROM, RAM capacity depends on the product.
 2. IC for mask ROM. V_{PP} for the μ PD78P014.

4.3.3 μ PD78024 (Preliminary)

Microcomputer for Control with On-Chip FIP Controller/Driver

Products: μ PD78023, 78024, 78P024 **Note**

Note Under development

The μ PD78024 is a 78K/0 series product with the same functions as the μ PD78014, but also incorporating a FIP controller/driver.

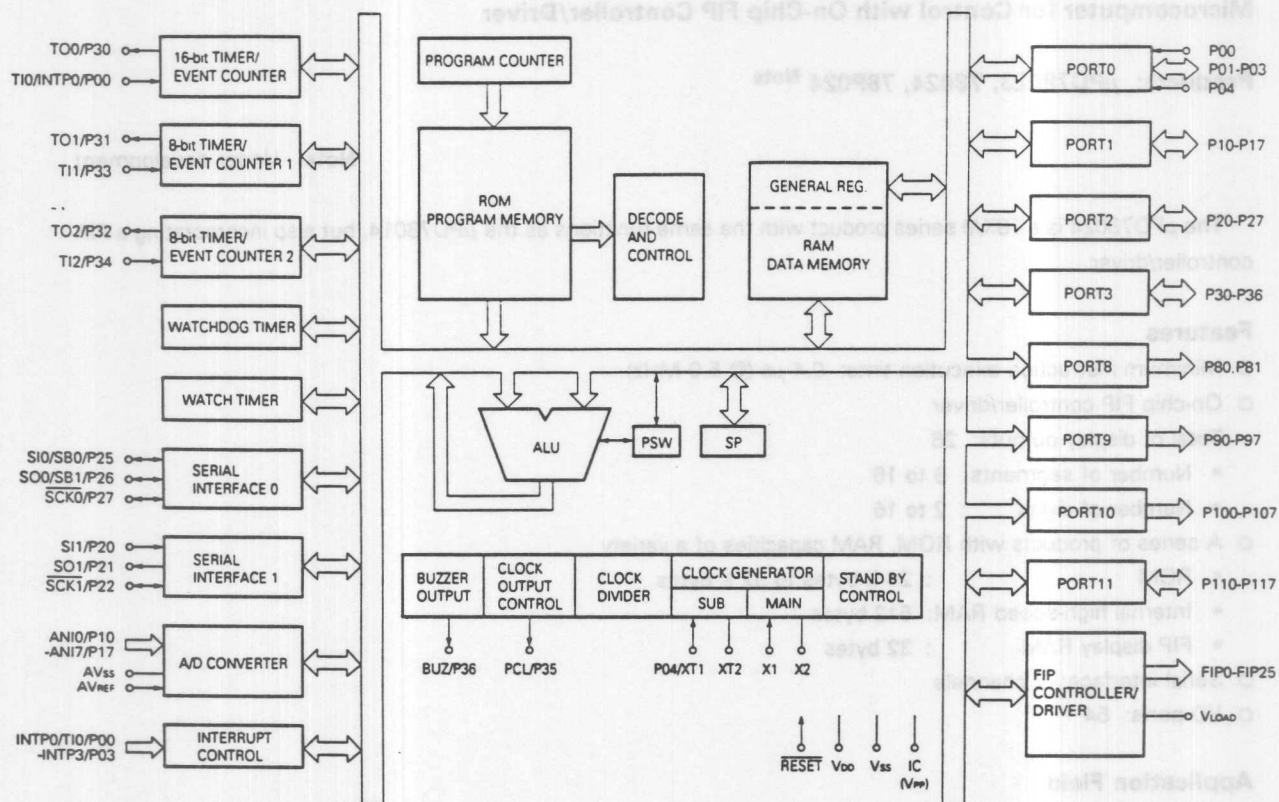
Features

- Minimum instruction execution time: $0.4 \mu\text{s}$ (@ 5.0 MHz)
- On-chip FIP controller/driver
 - Total of display outputs: 26
 - Number of segments: 9 to 16
 - Number of digits: 2 to 16
- A series of products with ROM, RAM capacities of a variety
 - ROM: 24 K bytes to 32 K bytes
 - Internal high-speed RAM: 512 bytes
 - FIP display RAM: 32 bytes
- Serial interface: 2 channels
- I/O ports: 54

Application Field

VCRs, audio equipment, microwave oven, etc.

Block Diagram



- Remarks**
1. Internal ROM capacity depends on the product.
 2. () is applied to the μ PD78P024 only.

4.3.4 μ PD78044A

Microcomputer for Control with On-Chip FIP Controller/Driver

Products: μ PD78042A, 78043A, 78044A, 78045A, 78P048A^{Note}

Note Under development

The μ PD78044A adds a 6-bit up/down counter to the μ PD78024 in the same 78K/0 series, and contains enhanced FIP controller/driver and I/O ports. With such a complete array of hardware on-chip, this device is perfect for applications such as VCRs and audio.

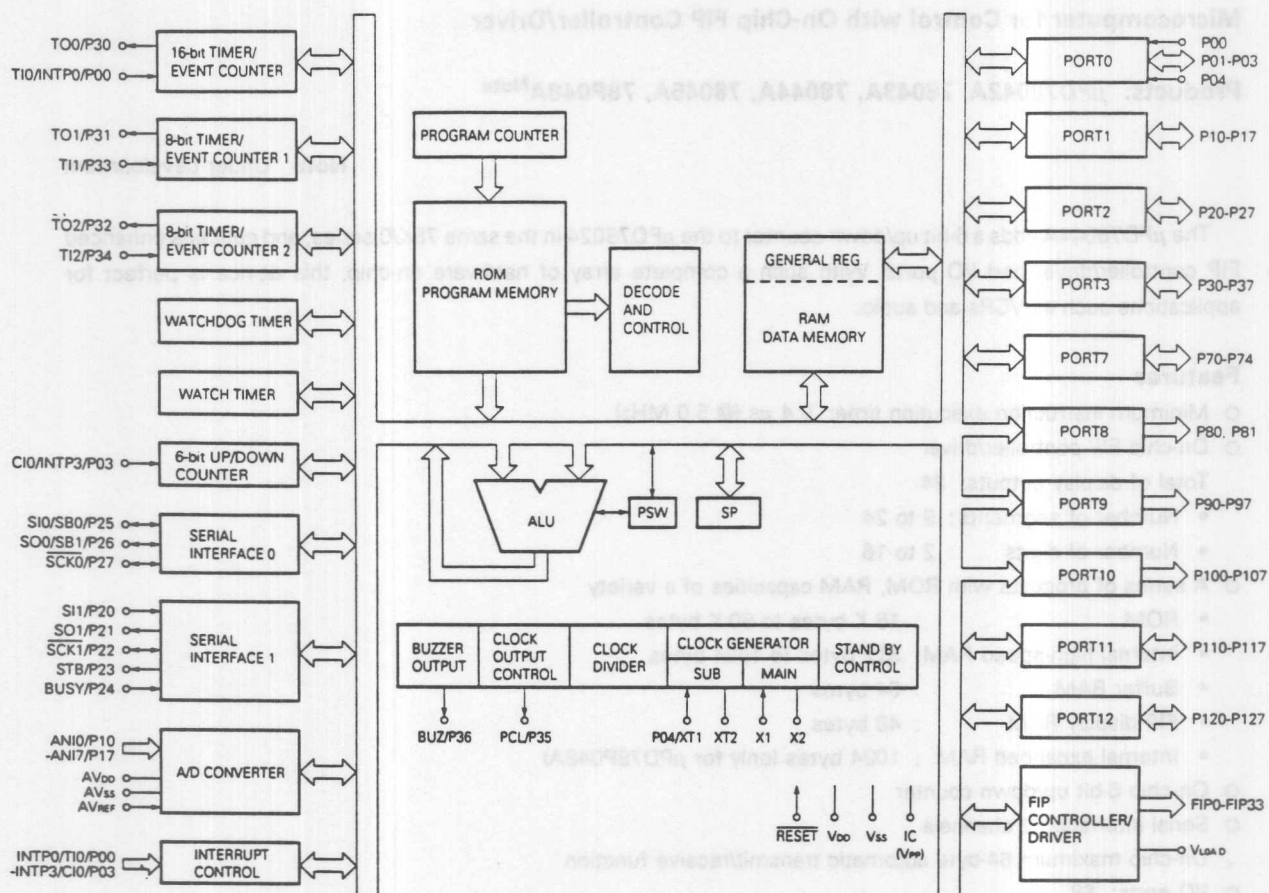
Features

- Minimum instruction execution time: 0.4 μ s (@ 5.0 MHz)
- On-chip FIP controller/driver
 - Total of display outputs: 34
 - Number of segments: 9 to 24
 - Number of digits : 2 to 16
- A series of products with ROM, RAM capacities of a variety
 - ROM : 16 K bytes to 60 K bytes
 - Internal high-speed RAM: 512 bytes to 1024 bytes
 - Buffer RAM : 64 bytes
 - FIP display RAM : 48 bytes
 - Internal expanded RAM : 1024 bytes (only for μ PD78P048A)
- On-chip 6-bit up/down counter
- Serial interface: 2 channels
 - On-chip maximum 64-byte automatic transmit/receive function
- I/O ports: 68

Application Field

VCRs, audio equipment, etc.

Block Diagram



- Remarks**
1. Internal ROM, RAM capacity depends on the product.
 2. () is applied to the μ PD78P048A only.

4.3.5 μ PD78054

Microcomputer for Control with On-Chip D/A and A/D Converters, and UART

Products: μ PD78052, 78053, 78054, 78P054, 78055, 78056, 78058, 78P058

The μ PD78054 is a product with enhanced functions such as serial interface and I/O port of the μ PD78014 of the same 78K/0 series, incorporating the additional 8-bit resolution D/A converter and real-time output port.

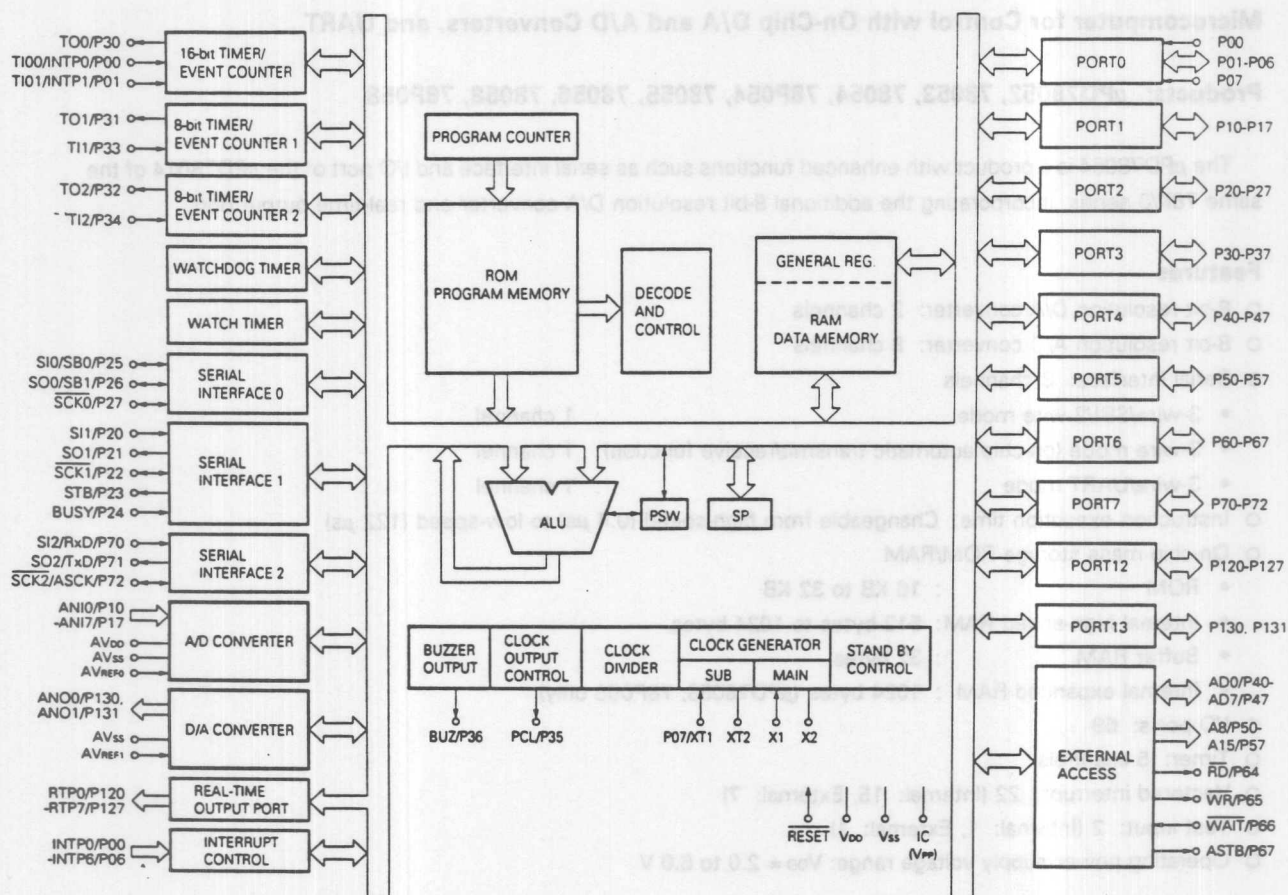
Features

- 8-bit resolution D/A converter: 2 channels
- 8-bit resolution A/D converter: 8 channels
- Serial interface: 3 channels
 - 3-wire/SBI/2-wire mode : 1 channel
 - 3-wire mode (on-chip automatic transmit/receive function): 1 channel
 - 3-wire/UART mode : 1 channel
- Instruction execution time: Changeable from high-speed (0.4 μ s) to low-speed (122 μ s)
- On-chip mass storage ROM/RAM
 - ROM : 16 KB to 32 KB
 - Internal high-speed RAM: 512 bytes to 1024 bytes
 - Buffer RAM : 32 bytes
 - Internal expanded RAM : 1024 bytes (μ PD78058, 78P058 only)
- I/O ports: 69
- Timer: 5 channels
- Vectored interrupt: 22 (Internal: 15, External: 7)
- Test input: 2 (Internal: 1, External: 1)
- Operating power supply voltage range: $V_{DD} = 2.0$ to 6.0 V

Application Field

Cellular phones, pagers, printers, AV equipment, etc.

Block Diagram



- Remarks**
1. Internal ROM and RAM capacity depends on the product.
 2. () is applied to the μ PD78P054 and 78P058 only.

4.3.6 μ PD78078 (Preliminary)

Microcomputer for Control with D/A and A/D Converters, and UART

Products: μ PD78074^{Note}, 78075^{Note}, 78076, 78078^{Note}, 78P078^{Note}

Note Under development

The μ PD78078 is a product with enhanced functions such as external interface and I/O port of the μ PD78054 of the same 78K/0 series, incorporating the additional two 8-bit timers.

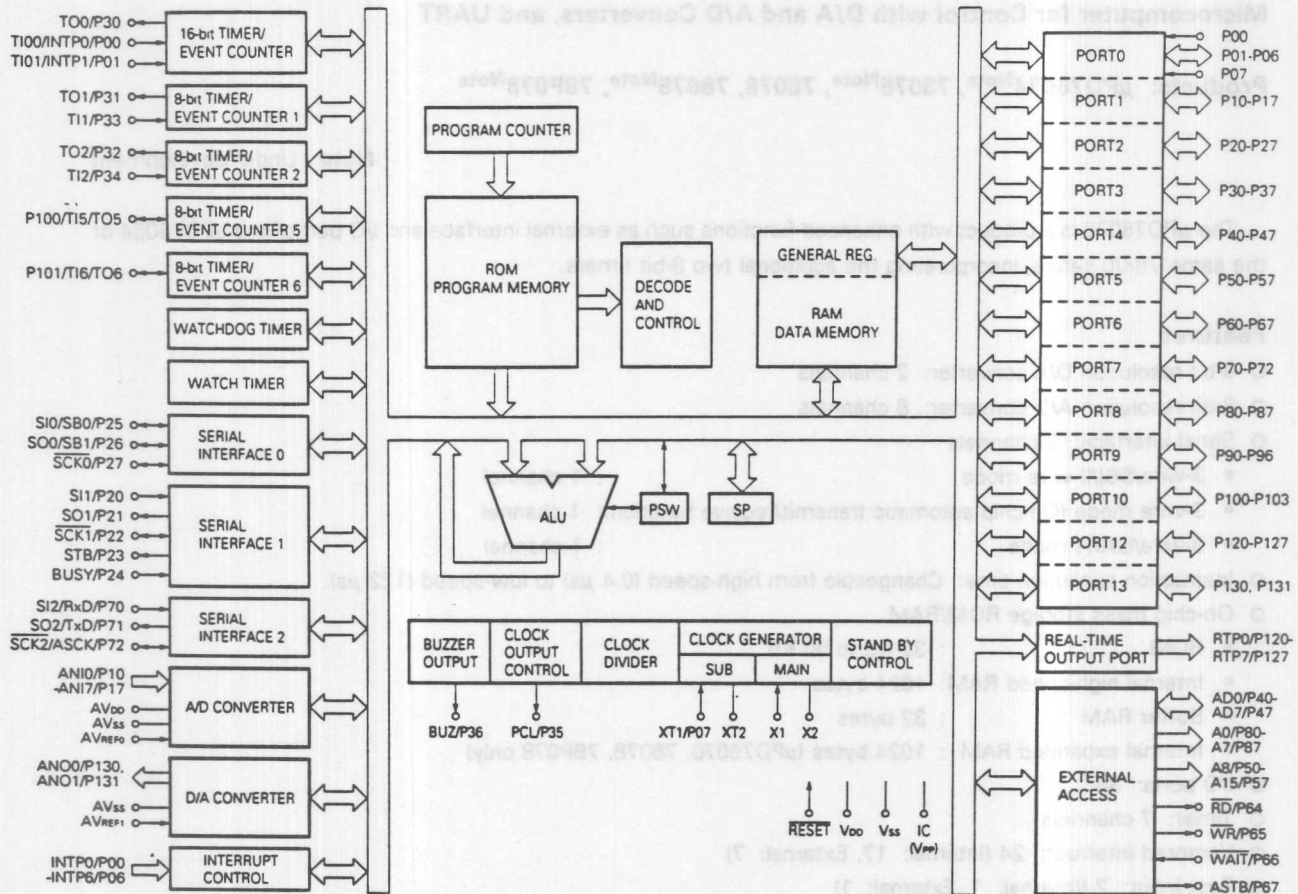
Features

- 8-bit resolution D/A converter: 2 channels
- 8-bit resolution A/D converter: 8 channels
- Serial interface: 3 channels
 - 3-wire/SBI/2-wire mode : 1 channel
 - 3-wire mode (On-chip automatic transmit/receive function): 1 channel
 - 3-wire/UART mode : 1 channel
- Instruction execution time: Changeable from high-speed (0.4 μ s) to low-speed (122 μ s)
- On-chip mass storage ROM/RAM
 - ROM : 32 KB to 60 KB
 - Internal high-speed RAM: 1024 bytes
 - Buffer RAM : 32 bytes
 - Internal expanded RAM : 1024 bytes (μ PD78076, 78078, 78P078 only)
- I/O ports: 88
- Timer: 7 channels
- Vectored interrupt: 24 (Internal: 17, External: 7)
- Test input: 2 (Internal: 1, External: 1)
- Operating power supply voltage range: $V_{DD} = 1.8$ to 5.5 V

Application Field

Cellular phones, pagers, printers, AV equipment, etc.

Block Diagram



Remarks 1. Internal ROM, RAM capacity depends on the product.

2. () is applied to the μ PD78P078 only.

4.3.7 μ PD78064

Microcomputer for Control with On-Chip LCD Controller/Driver and UART

Products: μ PD78062, 78063, 78064, 78P064

The μ PD78064 is a product with enhanced functions such as the serial interface and I/O port of the μ PD78014 of the same 78K/0 series, and additionally incorporating an LCD controller/driver.

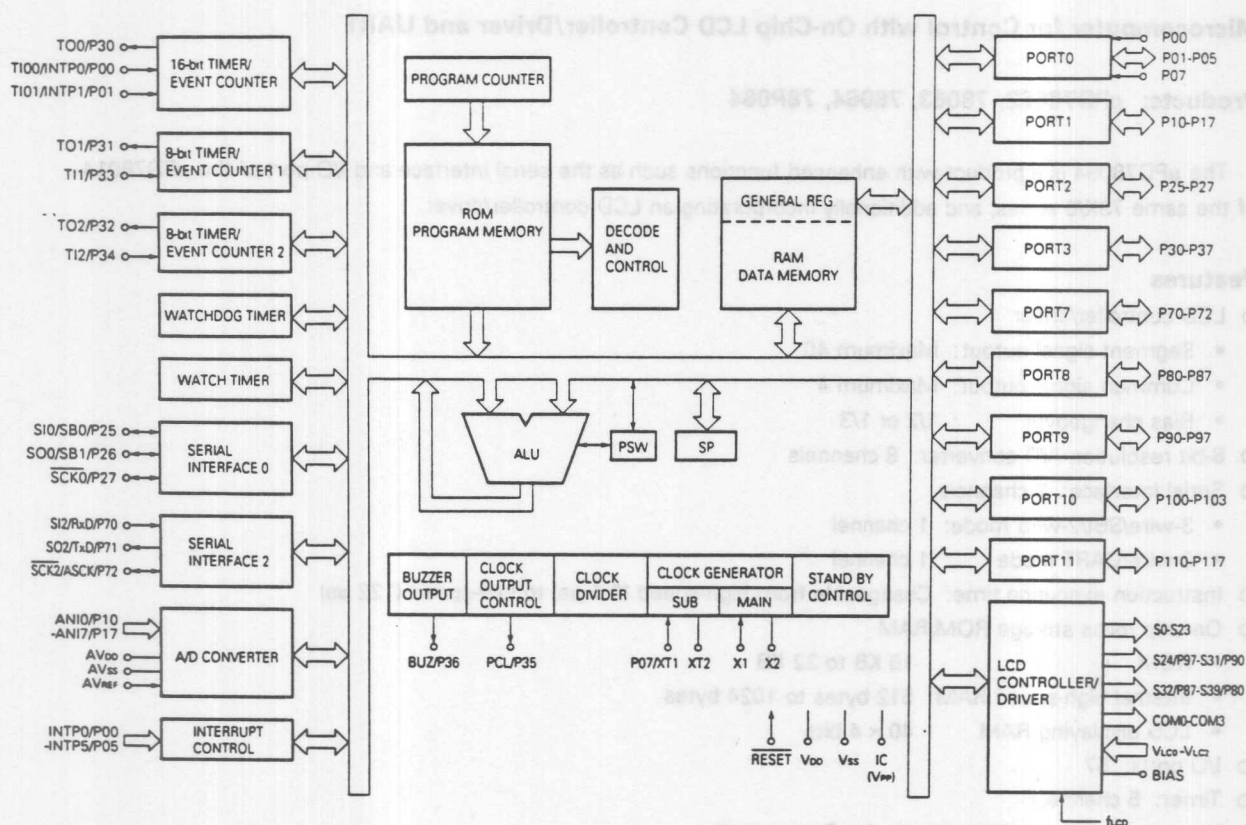
Features

- LCD controller/driver
 - Segment signal output: Maximum 40
 - Common signal output: Maximum 4
 - Bias changeover : 1/2 or 1/3
- 8-bit resolution A/D converter: 8 channels
- Serial interface: 2 channels
 - 3-wire/SBI/2-wire mode: 1 channel
 - 3-wire/UART mode : 1 channel
- Instruction execution time: Changeable from high-speed ($0.4 \mu\text{s}$) to low-speed ($122 \mu\text{s}$)
- On-chip mass storage ROM/RAM
 - ROM : 16 KB to 32 KB
 - Internal high-speed RAM: 512 bytes to 1024 bytes
 - LCD displaying RAM : 40×4 bits
- I/O ports: 57
- Timer: 5 channels
- Vectored interrupt: 20 (Internal: 14, External: 6)
- Test input: 2 (Internal: 1, External: 1)
- Operating power supply voltage range: $V_{DD} = 2.0$ to 6.0 V

Application Field

Cellular phones, pagers, CD and tape recorders and radios, cameras, etc.

Block Diagram



- Remarks**
1. Internal ROM and RAM capacity depends on the product.
 2. () is applied to the μ PD78P064 only.

4.3.8 μ PD78083 (Preliminary)

Microcomputer for Control with A/D Converter and UART

Products: μ PD78081, 78082, 78P083

In addition to a high-speed, high-performance CPU, the μ PD78082 contains on-chip peripheral hardware such as ROM, RAM, I/O ports, an 8-bit resolution A/D converter, timer, serial interface, interrupt controller, etc.

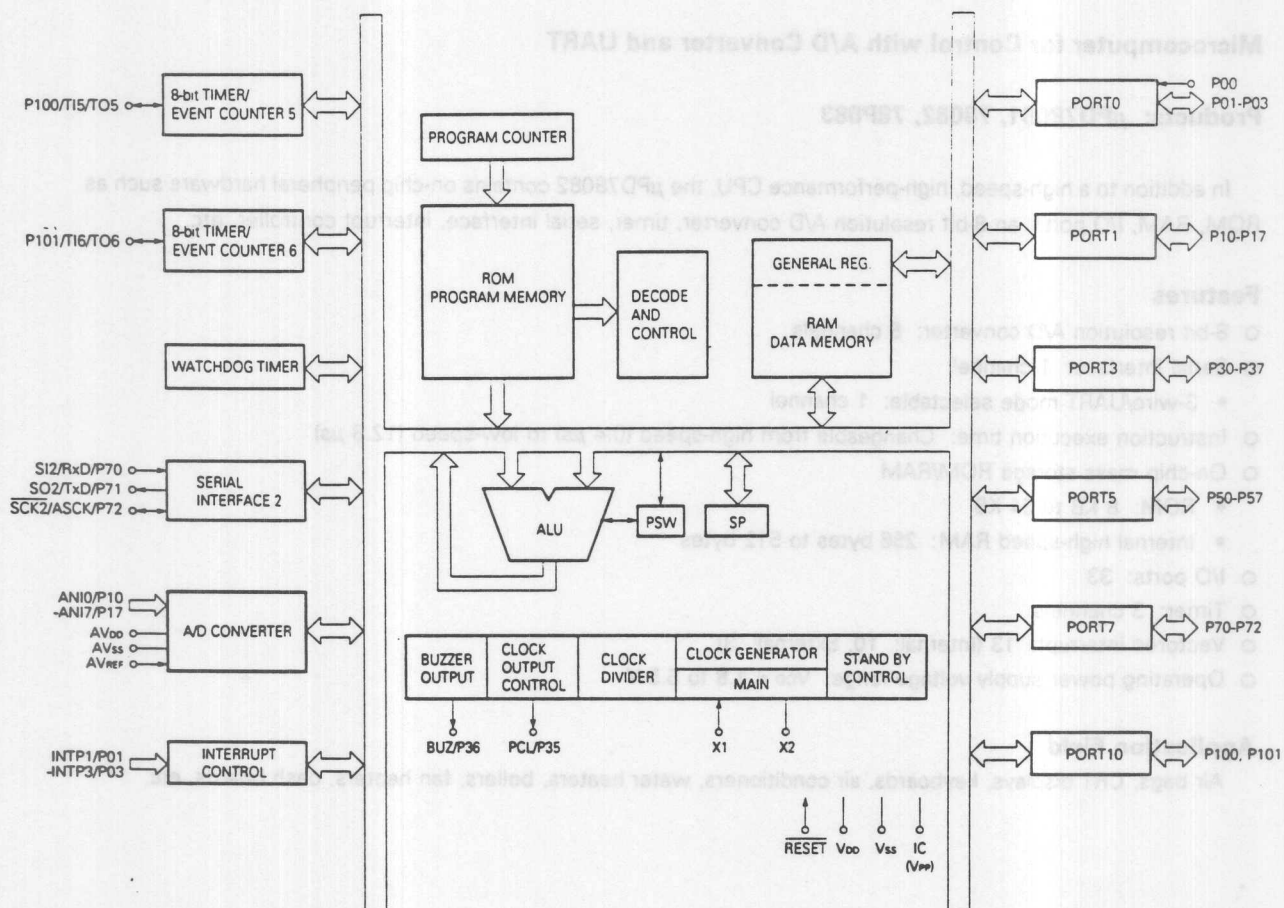
Features

- 8-bit resolution A/D converter: 8 channels
 - 3-wire/UART mode selectable: 1 channel
- Instruction execution time: Changeable from high-speed (0.4 μ s) to low-speed (12.8 μ s)
- On-chip mass storage ROM/RAM
 - ROM: 8 KB to 24 KB
 - Internal high-speed RAM: 256 bytes to 512 bytes
- I/O ports: 33
- Timer: 3 channels
- Vectored interrupt: 13 (Internal: 10, External: 3)
- Operating power supply voltage range: $V_{DD} = 1.8$ to 5.5 V

Application Field

Air bags, CRT displays, keyboards, air conditioners, water heaters, boilers, fan heaters, dash boards, etc.

Block Diagram



- Remarks**
1. Internal ROM and RAM capacity depends on the product.
 2. () is applied to the μ PD78P083 only.

4.3.9 μ PD78098

Microcomputer for Control with On-Chip IEBus Controller, D/A and A/D Converters, and UART

Products: μ PD78094, 78095, 78096, 78098A^{Note}, 78P098A^{Note}

Note Under development

The μ PD78098A is an advanced version of the μ PD78014 (78K/0 series), with IEBus controller, 8-bit resolution D/A converter, real-time output port, and improved serial interface and I/O port.

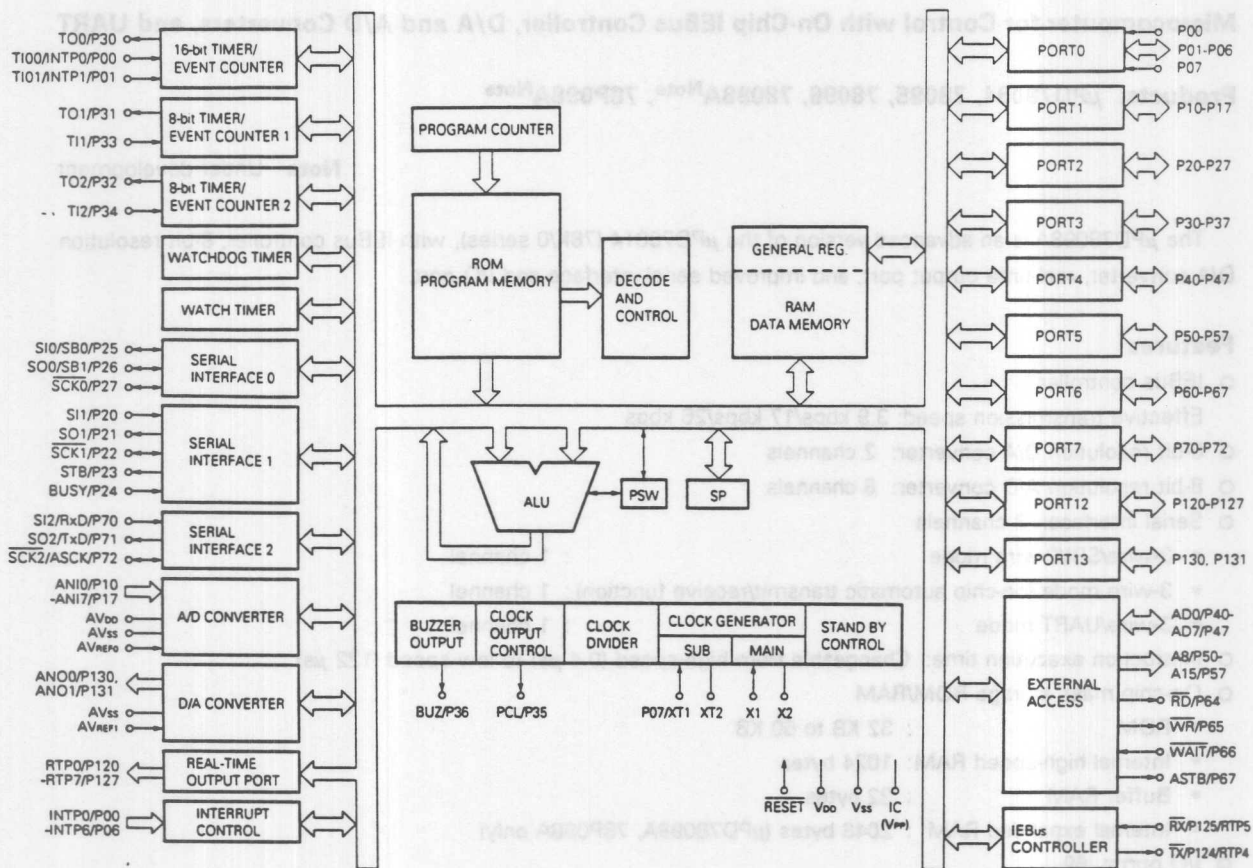
Features

- IEBus controller
 - Effective transmission speed: 3.9 kbps/17 kbps/26 kbps
- 8-bit resolution D/A converter: 2 channels
- 8-bit resolution A/D converter: 8 channels
- Serial interface: 3 channels
 - 3-wire/SBI/2-wire mode : 1 channel
 - 3-wire mode (on-chip automatic transmit/receive function): 1 channel
 - 3-wire/UART mode : 1 channel
- Instruction execution time: Changeable from high-speed (0.4 μ s) to low-speed (122 μ s)
- On-chip mass storage ROM/RAM
 - ROM : 32 KB to 60 KB
 - Internal high-speed RAM: 1024 bytes
 - Buffer RAM : 32 bytes
 - Internal expanded RAM : 2048 bytes (μ PD78098A, 78P098A only)
- I/O ports: 69
- Timer: 5 channels
- Vectored interrupt: 23 (Internal: 16, External: 7)
- Test input: 2 (Internal: 1, External: 1)
- Operating power supply voltage range: $V_{DD} = 2.7$ to 6.0 V

Application Field

Car-mounted audio equipment, CD changers, etc.

Block Diagram



- Remarks**
1. Internal ROM and RAM capacity depends on the product.
 2. IC for mask ROM. V_{PP} for the μPD78P098A.

4.3.10 μ PD78002Y

Microcomputer for System Control with On-Chip I²C Bus Supporting Serial Interface

Products: μ PD78001BY, 78002BY, 78P014Y

The μ PD78002BY is a product with μ PD78002B functions and incorporating an additional I²C bus supporting serial interface.

Features

- On-chip I²C bus supporting serial interface
- Serial interface: 1 channel
3-wire/SBI/2-wire/I²C bus mode
- Instruction execution time: Changeable from high-speed (0.4 μ s) to low-speed (122 μ s)
- On-chip mass storage ROM/RAM
 - ROM : 8 KB to 16 KB
 - Internal high-speed RAM: 256 bytes to 384 bytes
- I/O ports: 53
- Timer: 4 channels
- Vectored interrupt: 11 (Internal: 7, External: 4)
- Test input: 2 (Internal: 1, External: 1)
- Operating power supply voltage range: $V_{DD} = 2.7$ to 6.0 V

Application Field

Telephones, VCRs, audio equipment, cameras, home electric appliances, etc.



RESET	V _{DD}	V _{SS}	IC (V _{PP})
-------	-----------------	-----------------	--------------------------

4.3.11 μ PD78014Y

Microcomputer for Control with On-Chip I²C Bus Supporting Serial Interface and A/D Converter

Products: μ PD78011BY, 78012BY, 78013Y, 78014Y, 78P014Y

The μ PD78014Y is a product with μ PD78014 functions and incorporating an additional I²C bus supporting serial interface.

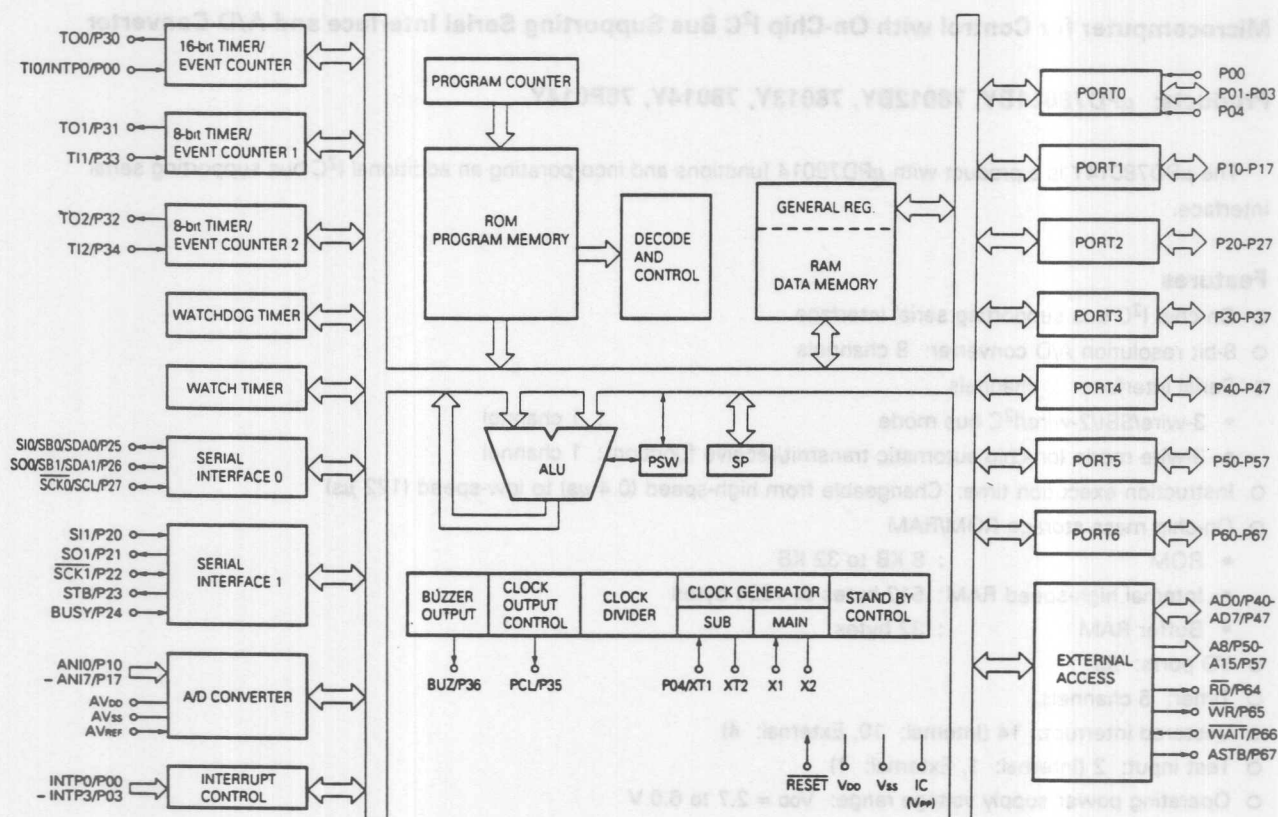
Features

- On-chip I²C bus supporting serial interface
- 8-bit resolution A/D converter: 8 channels
- Serial interface: 2 channels
 - 3-wire/SBI/2-wire/I²C bus mode : 1 channel
 - 3-wire mode (on-chip automatic transmit/receive function): 1 channel
- Instruction execution time: Changeable from high-speed (0.4 μ s) to low-speed (122 μ s)
- On-chip mass storage ROM/RAM
 - ROM : 8 KB to 32 KB
 - Internal high-speed RAM: 512 bytes to 1024 bytes
 - Buffer RAM : 32 bytes
- I/O ports: 53
- Timer: 5 channels
- Vectored interrupt: 14 (Internal: 10, External: 4)
- Test input: 2 (Internal: 1, External: 1)
- Operating power supply voltage range: $V_{DD} = 2.7$ to 6.0 V

Application Field

Telephones, VCRs, audio equipment, cameras, home electric appliances, etc.

Block Diagram



- Remarks**
1. Internal ROM and RAM capacity depends on the product.
 2. () is applied to the μ PD78P014Y only.

4.3.12 μ PD78054Y

Microcomputer for Control with On-Chip I²C Bus Supporting Serial Interface, D/A and A/D Converters, and UART

Products: μ PD78052Y, 78053Y, 78054Y, 78P054Y^{Note}, 78055Y, 78056Y, 78058Y^{Note}, 78P058Y^{Note}

Note Under development

The μ PD78054Y is similar to the μ PD78054 except for I²C bus control function replacing the SBI mode and different serial interface channel 0.

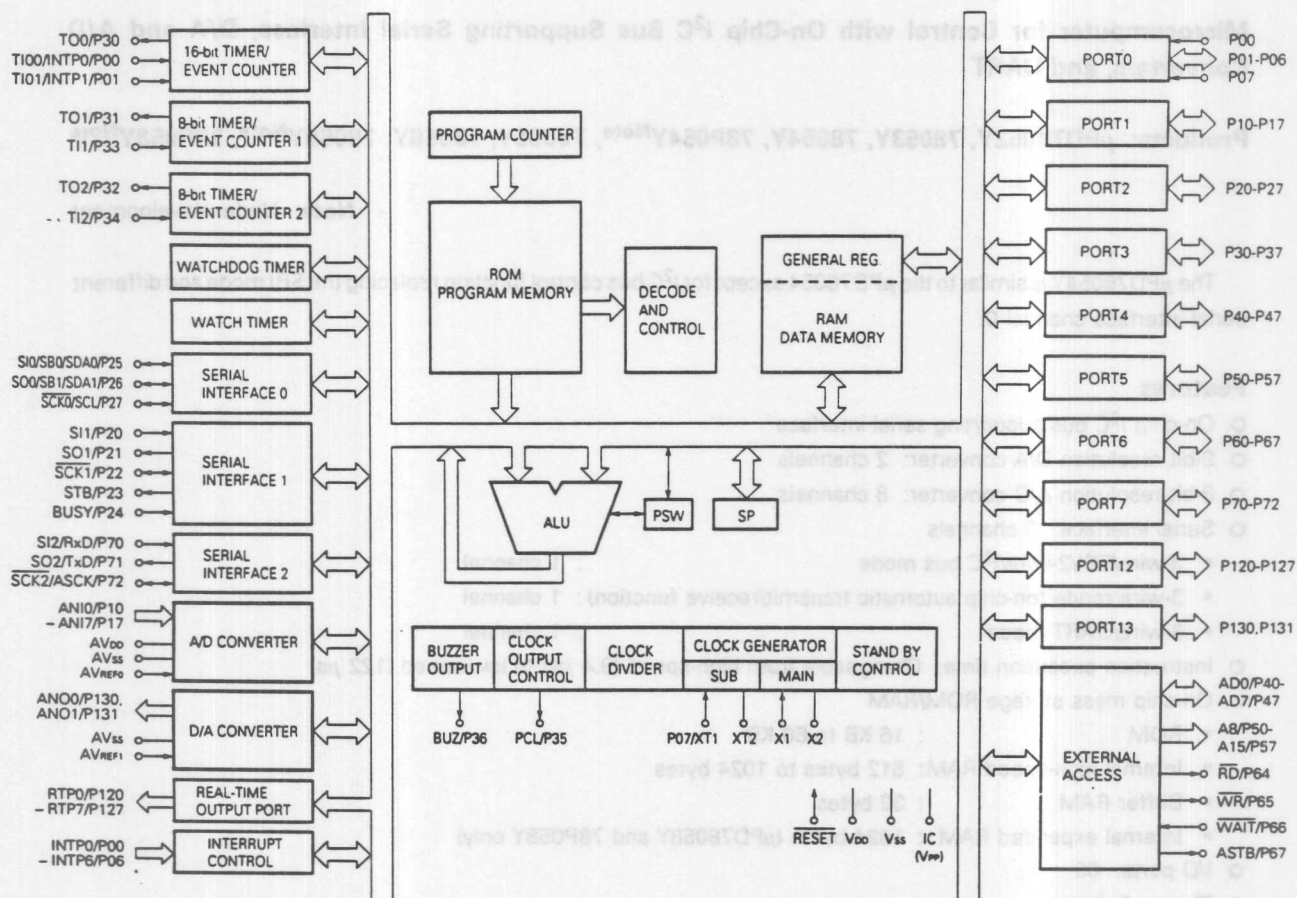
Features

- On-chip I²C bus supporting serial interface
- 8-bit resolution D/A converter: 2 channels
- 8-bit resolution A/D converter: 8 channels
- Serial interface: 3 channels
 - 3-wire/SBI/2-wire/I²C bus mode : 1 channel
 - 3-wire mode (on-chip automatic transmit/receive function) : 1 channel
 - 3-wire/UART mode : 1 channel
- Instruction execution time: Changeable from high-speed (0.4 μ s) to low-speed (122 μ s)
- On-chip mass storage ROM/RAM
 - ROM : 16 KB to 60 KB
 - Internal high-speed RAM: 512 bytes to 1024 bytes
 - Buffer RAM : 32 bytes
 - Internal expanded RAM : 1024 bytes (μ PD78058Y and 78P058Y only)
- I/O ports: 69
- Timer: 5 channels
- Vectored interrupt: 22 (Internal: 15, External: 7)
- Test input: 2 (Internal: 1, External: 1)
- Operating power supply voltage range: $V_{DD} = 2.0$ to 6.0 V

Application Field

Cellular phones, pagers, printers, AV equipment, etc.

Block Diagram



Remarks 1. Internal ROM, RAM capacity depends on the product.

2. () is applied to the μ PD78P054Y and 78P058Y only.

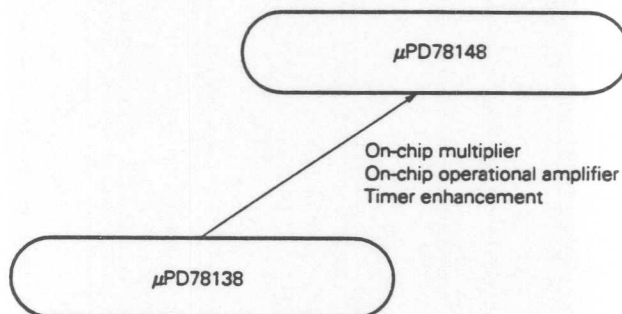
4.4 78K/I Series

The 78K/I series comprises 8-bit single-chip microcomputers which are mainly used for digital servo control in VCRs, etc. Products in this series incorporate a variety of peripheral hardware such as a Super Timer Unit which facilitates digital servo control by software, and A/D converter, and a PWM output function.

Products in the 78K/I series are shown below.

Series	Title (Subseries)	Part No.	Page
78K/I	μ PD78138	μ PD78134 78134A 78136 78138 78P138	81
	μ PD78148	μ PD78146 78148 78P148	83

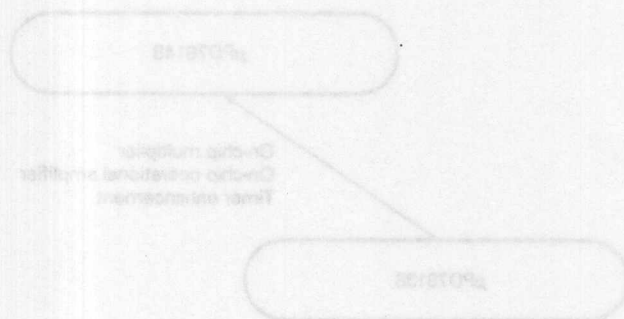
78K/I Series Product Development



The 78K1 series comprises 8-bit single-chip microcomputers which are mainly used for digital servo control in VCRs etc. Products in this series incorporate a variety of peripheral hardware such as a Super Timer Unit which facilitates digital servo control by software, and A/D converter, and a PWM output function. Products in the 78K1 series are shown below.

Series	Title (Subseries)	Part No.	Page
78K1	78K135	78K135A 78K135 78K135	81
	78K145	78K145 78K145	82

78K1 Series Product Development



4.4.1 μ PD78138

Large Capacity On-Chip ROM, Ideal for VCR Servo Control

Products: μ PD78134, 78134A, 78136, 78138, 78P138

The μ PD78138 is an 8-bit single-chip microcomputer which incorporates a high-speed and high-performance 8-bit CPU.

The μ PD78138 has on-chip peripheral hardware suited to software servo control, and is ideal for applications which require digital servo control, including VCRs.

The large-capacity on-chip ROM allow the μ PD78138 to implement system control as well as servo control in a single chip, enabling the application set size to be reduced.

A PROM version, the μ PD78P138, is also available. It is ideal for evaluation and preproduction in system development, and for early startup of application sets and limited production.

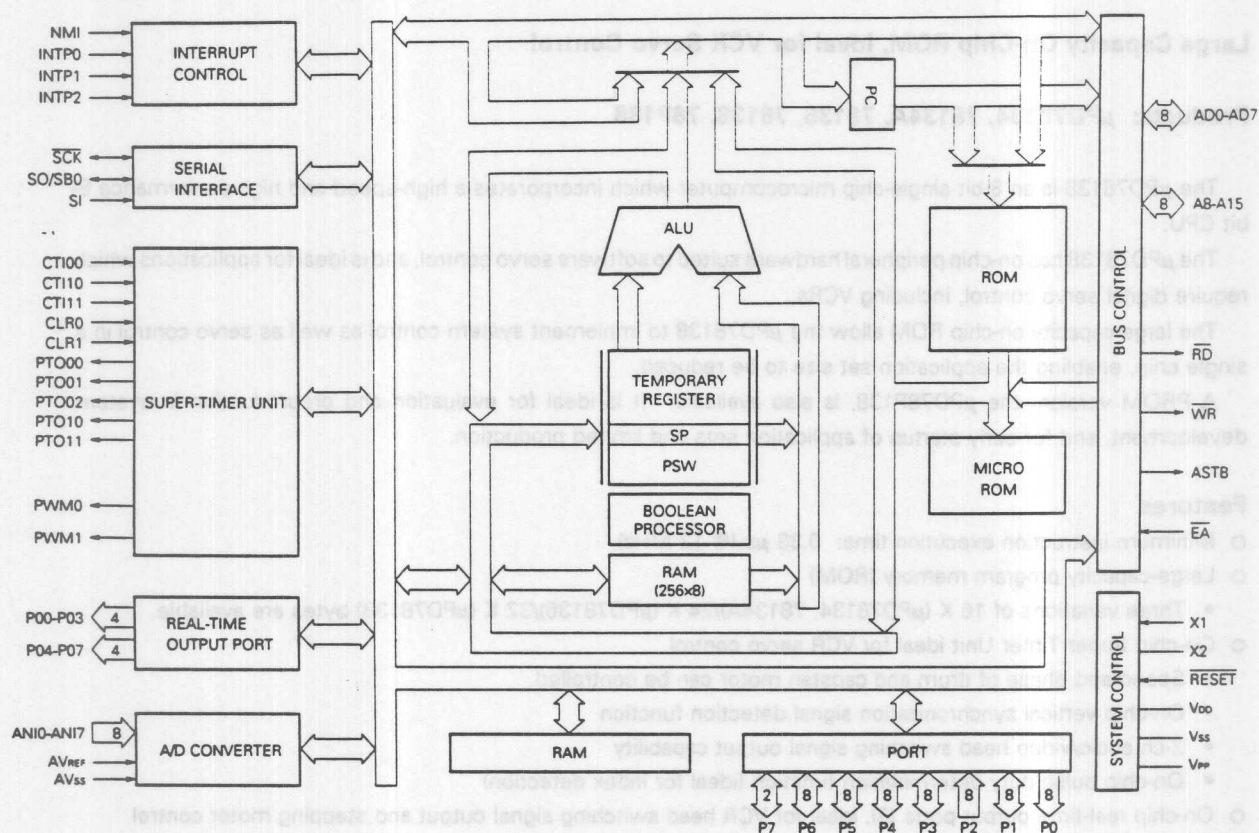
Features

- Minimum instruction execution time: 0.33 μ s (@ 12 MHz)
- Large-capacity program memory (ROM)
 - Three variations of 16 K (μ PD78134, 78134A)/24 K (μ PD78136)/32 K (μ PD78138) bytes are available.
- On-chip Super Timer Unit ideal for VCR servo control
 - Speed and phase of drum and capstan motor can be controlled.
 - On-chip vertical synchronization signal detection function
 - 2-ch audio/video head switching signal output capability
 - On-chip pulse duty determination function (ideal for index detection)
- On-chip real-time output ports (8), ideal for VCR head switching signal output and stepping motor control
- On-chip powerful interrupt functions with choice of two processing modes
 - Vectored interrupts and macro service (easy implementation of automatic data transfer or beginning-of-tape function in VCR)
- On-chip pull-up resistors (44): External resistors not required
- Added functions for improved servo control responsiveness
 - Signed multiplication instruction (MULSW instruction): 16-bit complement \times 8-bit absolute value (except μ PD78134)
 - 23.4 kHz or 46.9 kHz selectable as PWM output carrier frequency (except μ PD78134)
 - Addition of addressing mode to facilitate data transfers in 64 K-byte space

Application Field

Servo control applications including VCRs (deck type and camcorder type), DAT, and CDPs.

Block Diagram



- Remarks**
1. Internal ROM, RAM capacity depends on the product.
 2. V_{PP} for the μPD78P138.

4.4.2 μ PD78148

Microcomputer for VCR with On-Chip Analog Amplifier

Products: μ PD78146, 78148, 78P148

The μ PD78148 is an 8-bit single-chip microcomputer.

The μ PD78148 enhances the previous products μ PD78138 timer and adds the multiplier and clock function, improving hardware function drastically.

In these products, I/O pins are extended and 2 analog amplifiers (operation amplifiers) are incorporated. This is effective in reducing external parts. And a 0.65-mm pitch, 100-pin QFP is used, enabling small-sized application sets. These functions allow the implementation of various system controls in a single chip.

A PROM version, the μ PD78P148, is available, in which the on-chip ROM of the μ PD78148 is replaced with one-time PROM. It is ideal for evaluation in system development, and for early startup of application system and limited production.

Features

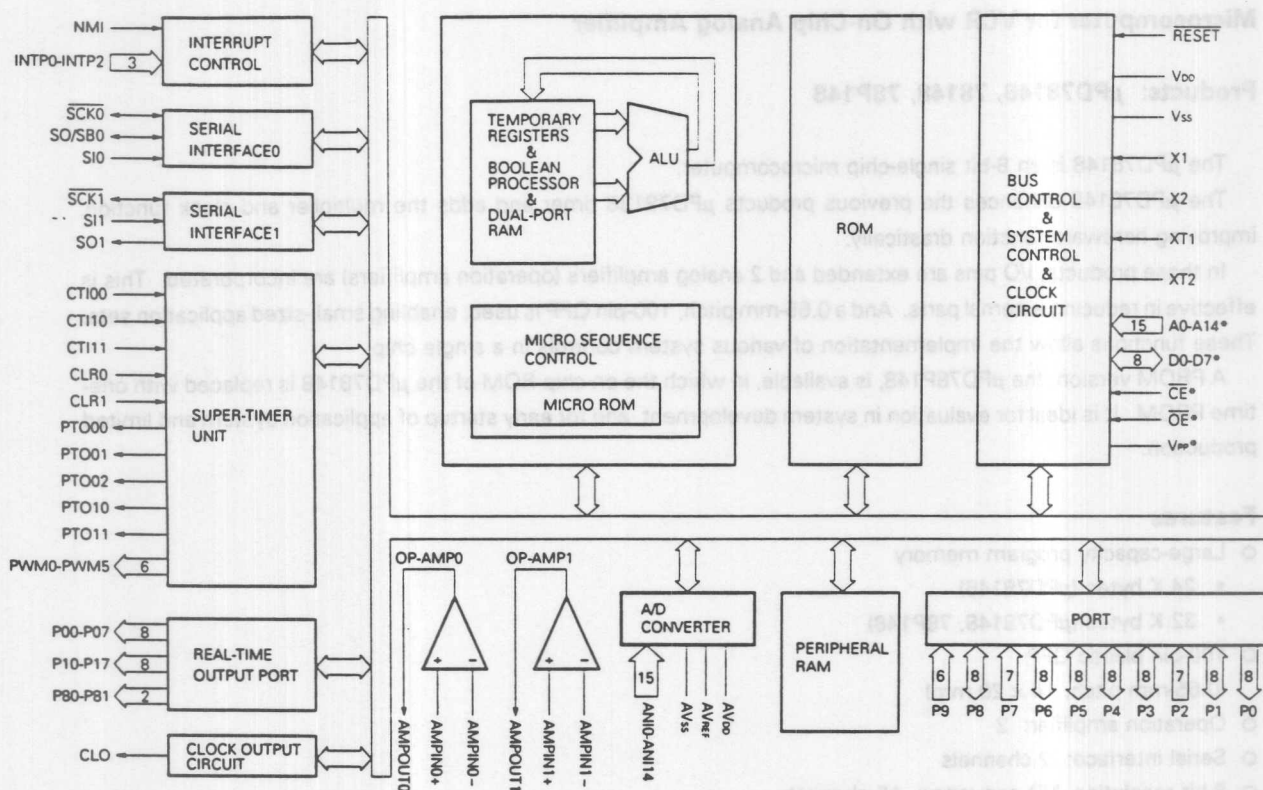
- Large-capacity program memory
 - 24 K bytes (μ PD78146)
 - 32 K bytes (μ PD78148, 78P148)
- 100-pin plastic QFP
(0.65-mm pitch, 14 x 20 mm)
- Operation amplifier: 2
- Serial interface: 2 channels
- 8-bit resolution A/D converter: 15 channels
- High-speed multiplier (hardware)
- Dual clock configuration
 - Capable of clock operation in standby mode
- Real-time output port: 18
- Enhanced super timer unit
 - Easy implementation of speed and phase control of drum and capstan motor
 - Vertical synchronization signal detection circuit
 - Pulse duty determination function
 - Up/down-counter
 - Write circuit after record control signal
 - Pseudo vertical synchronization signal generator
- Enhanced PWM output function (6 in total)
 - PWM carrier maximum frequency: 46.9 kHz
 - Tuner control 14-bit resolution PWM output
- Remote control receive hardware

Application Field

VCR system control/servo control

- Deck type
- Camcorder type

Block Diagram



Remarks 1. Internal ROM, RAM capacity depends on the product.

2. *: Only when PROM programming is operated.

4.5 78K/II Series

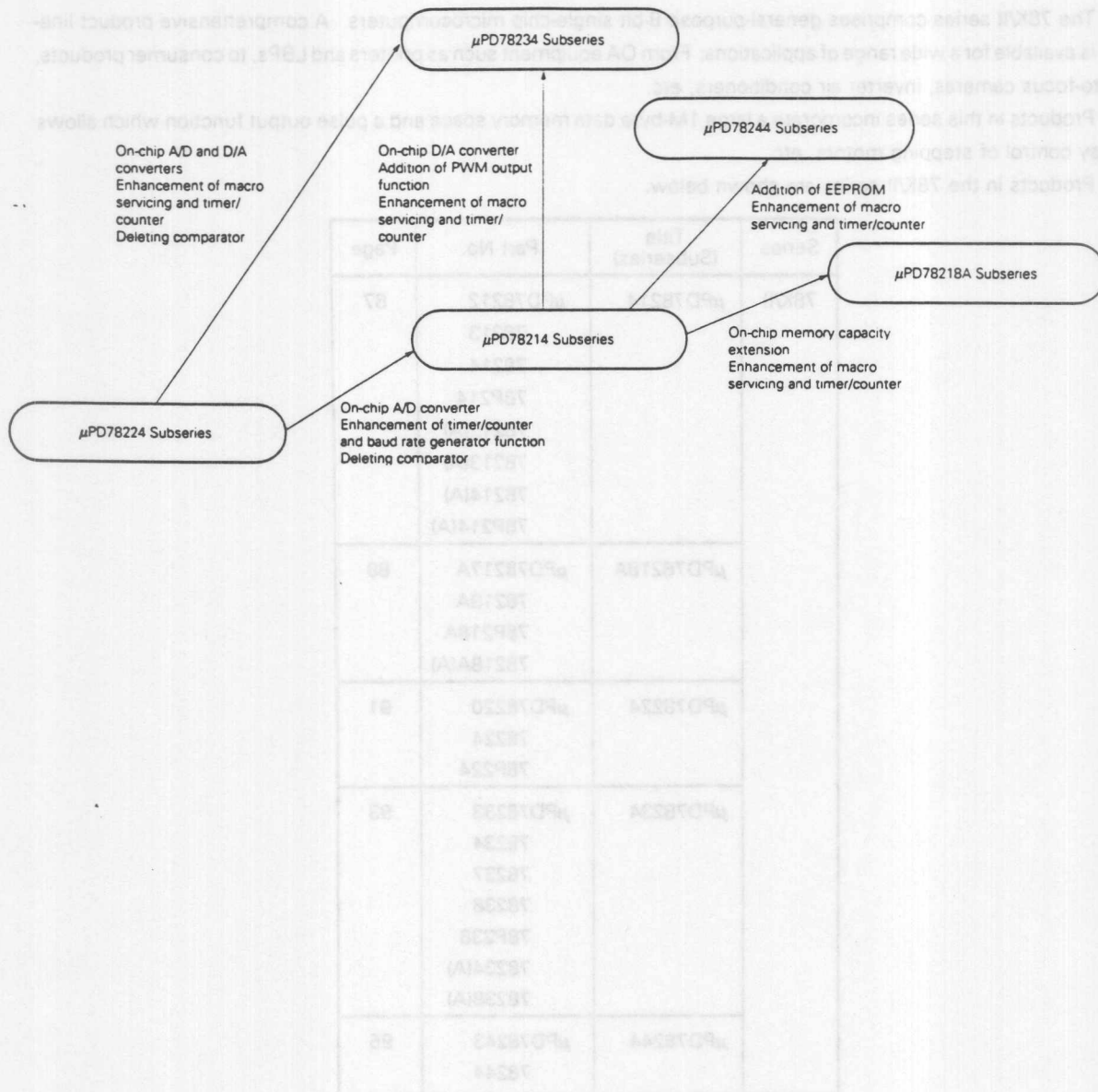
The 78K/II series comprises general-purpose 8-bit single-chip microcomputers. A comprehensive product line-up is available for a wide range of applications: From OA equipment such as printers and LBPs, to consumer products, auto-focus cameras, inverter air conditioners, etc.

Products in this series incorporate a large 1M-byte data memory space and a pulse output function which allows easy control of stepping motors, etc.

Products in the 78K/II series are shown below.

Series	Title (Subseries)	Part No.	Page
78K/II	μ PD78214	μ PD78212 78213 78214 78P214 78212(A) 78213(A) 78214(A) 78P214(A)	87
		μ PD78218A 78218A 78P218A 78218A(A)	89
		μ PD78224 78224 78P224	91
		μ PD78234 78234 78237 78238 78P238 78234(A) 78238(A)	93
		μ PD78244 78243 78244	95

78K/II Series Product Development



4.5.1 μ PD78214

On-Chip A/D Converter Product with Large-Capacity Memory Access Capability

Products: μ PD78212, 78213, 78214, 78P214, 78212(A), 78213(A), 78214(A), 78P214(A)

The μ PD78214 is an 8-bit single-chip microcomputer which incorporates a high-speed, high-performance 8-bit CPU. In this product, a large-capacity memory and peripheral hardware including a high-resolution A/D converter, serial interface, high-performance timer/counters, etc., are integrated in a single chip.

The μ PD78212 has 8 K bytes of ROM as compared with the 16 K bytes of the μ PD78214, and 384 bytes of RAM compared with the 512 bytes of the μ PD78214.

The μ PD78213 is a ROM-less version of the μ PD78214.

In the μ PD78P214, the on-chip mask ROM of the μ PD78214 is replaced with one-time PROM or EPROM.

The μ PD78212(A), 78213(A), 78214(A), 78P214(A) are "Special" quality grade versions of the μ PD78212, 78213, 78214, 78P214, respectively.

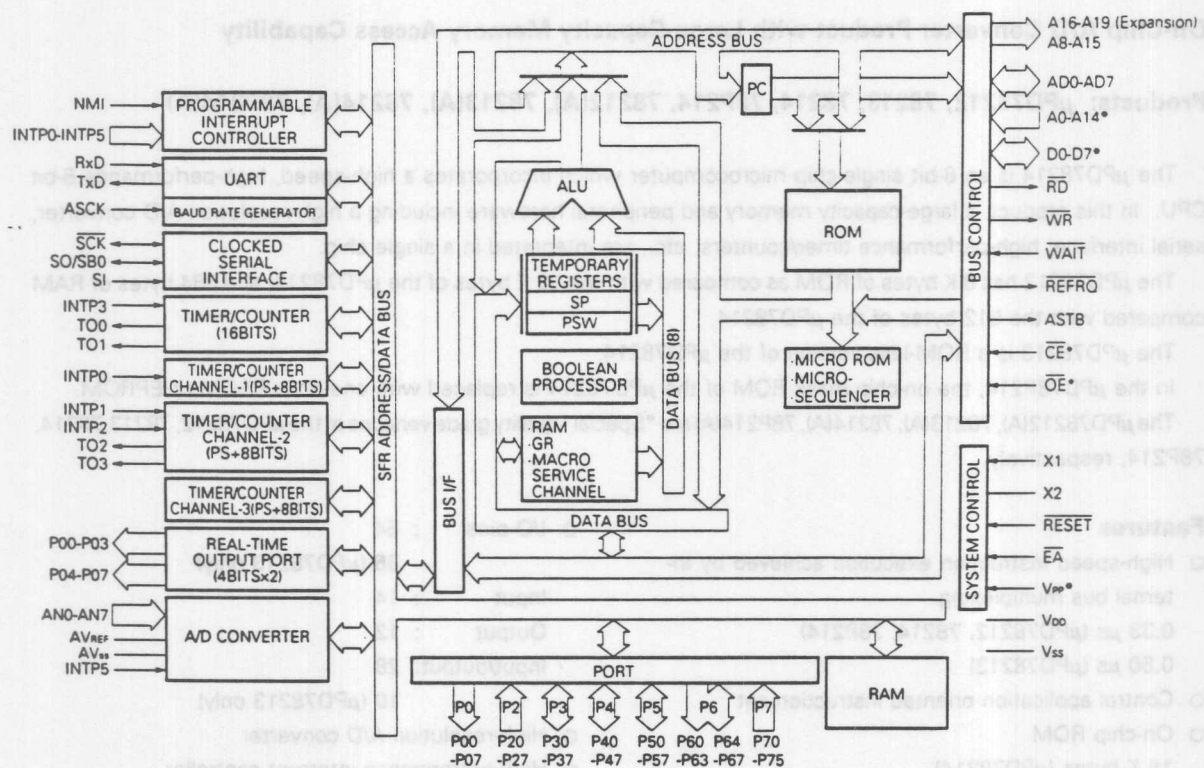
Features

- High-speed instruction execution achieved by internal bus multiplexing
 - 0.33 μ s (μ PD78212, 78214, 78P214)
 - 0.50 μ s (μ PD78213)
- Control application oriented instruction set
- On-chip ROM
 - 16 K bytes (μ PD78214)
 - 8 K bytes (μ PD78212)
- On-chip PROM
 - 16 K bytes (μ PD78P214 only)
 - One-time PROM version
 - EPROM version
- On-chip RAM
 - 512 bytes (μ PD78213, 78214, 78P214)
 - 384 bytes (μ PD78212)
- I/O pins : 54
- High-resolution A/D converter
- High-performance interrupt controller
 - Vectored interrupts
 - Macro service
- Serial interface
 - UART (on-chip baud rate generator)
 - CSI (3-wire serial I/O, SBI^{Note})
- Note** NEC standard serial bus interface

Application Field

- Standard products: OA equipment including printers, typewriters, PPCs, facsimile, etc., electronic musical instruments, inverters, cameras, etc.
- Special products: Automotive electrical equipment, fuel injection control

Block Diagram



- Remarks**
1. Internal ROM, RAM capacity depends on the product.
 2. *: In PROM programming mode

4.5.2 μ PD78218A

μ PD78214 Function Extended Version

Products: μ PD78217A, 78218A, 78P218A, 78218A(A)

The μ PD78218A is a 78K/II-series product which incorporates a high-speed and high-performance CPU. This is a large capacity memory version of the μ PD78214 in which peripheral hardware including the 8-bit resolution A/D converter, serial interface, high-performance timer/counter is integrated into a single chip. In addition to an expanded memory capacity, it features extended timer/counter and macro service functions.

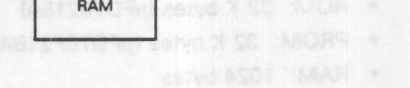
A PROM version is also available. It is ideal for evaluation and preproduction in system development, and for early startup of application products and limited production.

Features

- Upper compatible to the μ PD78214 (pin compatible)
- High-speed instruction execution
0.33 μ s (μ PD78218A, 78P218A)
0.50 μ s (μ PD78217A)
- On-chip memory
 - ROM-less: (μ PD78217A)
 - ROM: 32 K bytes (μ PD78218A)
 - PROM: 32 K bytes (μ PD78P218A)
 - RAM: 1024 bytes
- On-chip high-performance interrupt controller
- On-chip A/D converter (8 bits \times 8 channels)
- I/O pins: 54
- Real-time output port (8 \times 1, or 4 \times 2)
- Serial interface: 2 channels
- Timer/counter (16 \times 1, and 8 \times 3)

Differences between μ PD78218A and μ PD78214

Part No.		μ PD78218A	μ PD78214
Item			
On-chip memory	ROM	32 K bytes	16 K bytes
	RAM	1024 bytes	512 bytes
16-bit timer		One-shot pulse output	—
Macro service counter		8-bit/16-bit selectable	8-bit only
Oscillation stabilization time during STOP mode release		15 bits in a dedicated counter, or NMI active pulse width + 16 bits in a dedicated counter	NMI active pulse width + 16 bits in a dedicated counter



4.5.3 μ PD78224

Oriented toward High-Performance Real-Time Control

Products: μ PD78220, 78224, 78P224

The μ PD78224 is an 8-bit single-chip microcomputer in the 78K/II series.

In the μ PD78224, multi-function timer/counters, two independent serial interface channels, etc., are integrated in a single chip.

The μ PD78P224 is a QTOPTM microcomputer which incorporates one-time PROM in place of the mask ROM of the μ PD78224, and is suitable for evaluation during system development and limited production.

The μ PD78220 has no on-chip ROM.

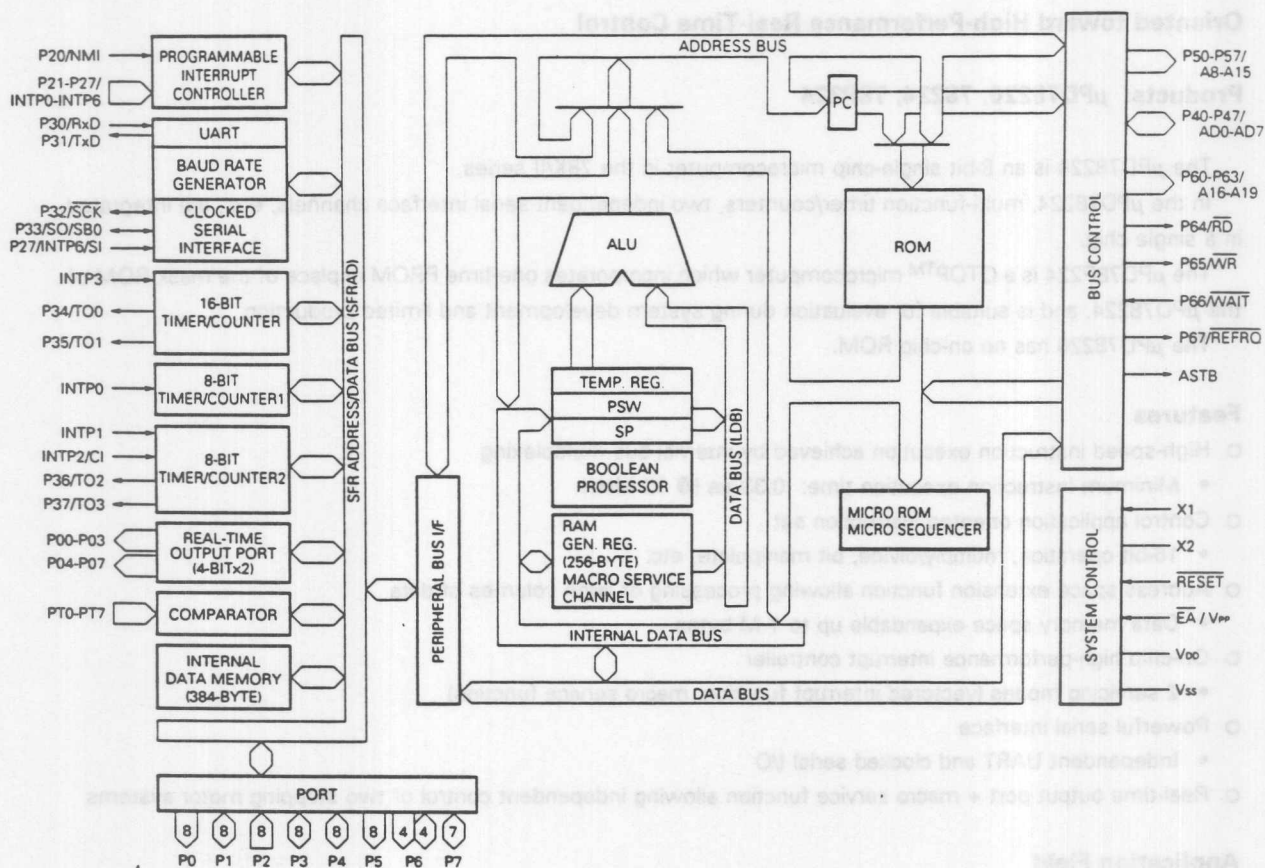
Features

- High-speed instruction execution achieved by internal bus multiplexing
 - Minimum instruction execution time: 0.33 μ s (@ 12 MHz)
- Control application oriented instruction set
 - 16-bit operation, multiply/divide, bit manipulate, etc.
- Address space extension function allowing processing of large volumes of data
 - Data memory space expandable up to 1 M bytes
- On-chip high-performance interrupt controller
 - 2 servicing modes (vectored interrupt function, macro service function)
- Powerful serial interface
 - Independent UART and clocked serial I/O
- Real-time output port + macro service function allowing independent control of two stepping motor systems

Application Field

- Fields in which large volumes of data are handled, such as kanji character generators, etc.
Printers, typewriters, portable word processors, ECRs, etc.

Block Diagram



Remarks 1. Internal ROM capacity depends on the product.

2. V_{PP} for the μPD78P224.

4.5.4 μ PD78234

Full Analog Data Input/Output Functions

Products: μ PD78233, 78234, 78237, 78238, 78P238, 78234(A), 78238(A)

The μ PD78234 incorporates a high-speed, high-performance CPU. This 8-bit single-chip microcomputer also incorporate large-capacity memory and a variety of peripheral hardware in a single chip, including a high-resolution A/D converter and D/A converter, serial interface, and high-performance timer/counters.

The μ PD78234(A) and μ PD78238(A) are "Special" quality grade versions of the μ PD78234 and μ PD78238.

Features

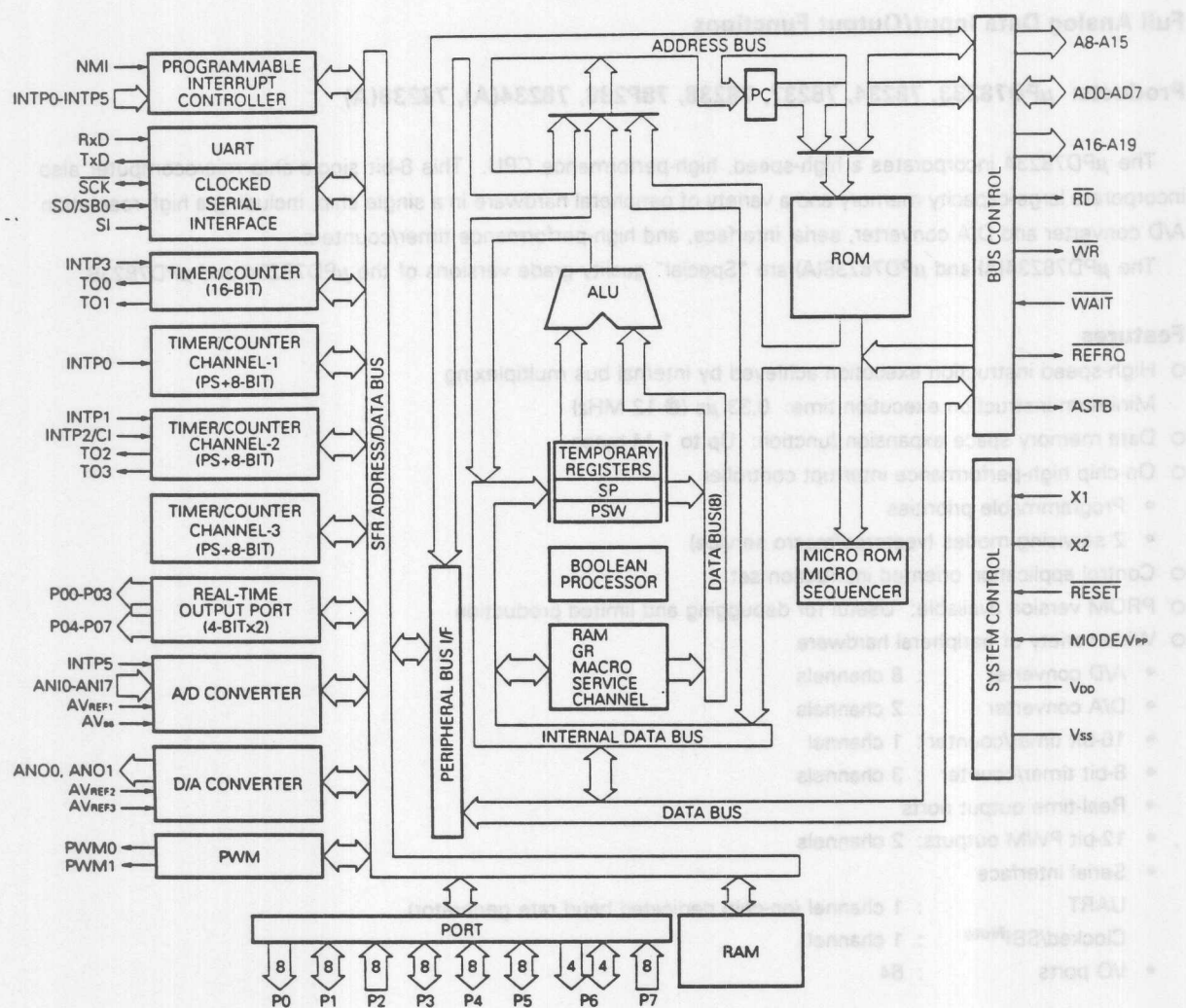
- High-speed instruction execution achieved by internal bus multiplexing
Minimum instruction execution time: 0.33 μ s (@ 12 MHz)
- Data memory space expansion function: Up to 1 M bytes
- On-chip high-performance interrupt controller
 - Programmable priorities
 - 2 servicing modes (vectored/macro service)
- Control application oriented instruction set
- PROM version available: Useful for debugging and limited production
- Wide variety of peripheral hardware
 - A/D converter : 8 channels
 - D/A converter : 2 channels
 - 16-bit timer/counter : 1 channel
 - 8-bit timer/counter : 3 channels
 - Real-time output ports
 - 12-bit PWM outputs: 2 channels
 - Serial interface
 - UART : 1 channel (on-chip dedicated baud rate generator)
 - Clocked/SBI^{Note} : 1 channel
 - I/O ports : 64

Note NEC standard serial bus

Application Field

- Standard products: OA equipment including LBPs, printers, typewriters, FDDs, HDDs, PPCs, and facsimile machines, etc., electronic musical instruments, inverter control equipment, cameras, air conditioners, etc.
- Special products : Automotive electrical equipment, fuel injection control

Block Diagram



- Remarks**
1. Internal ROM, RAM capacity depends on the product.
 2. V_{PP} for the μ PD78P238.

4.5.5 μ PD78244

First 78K Series On-Chip EEPROM Products

Products: μ PD78243, 78244

The μ PD78244 comprises 78K/II series products incorporating electrically erasable/programmable EEPROM (512 bytes). Products in this series are 8-bit single-chip microcomputers which can access a maximum of 1 M-byte of memory space by means of external expansion.

The μ PD78244 incorporates 16 K-byte mask ROM and 512-byte RAM.

The μ PD78243 is a ROM-less version of the μ PD78244.

Features

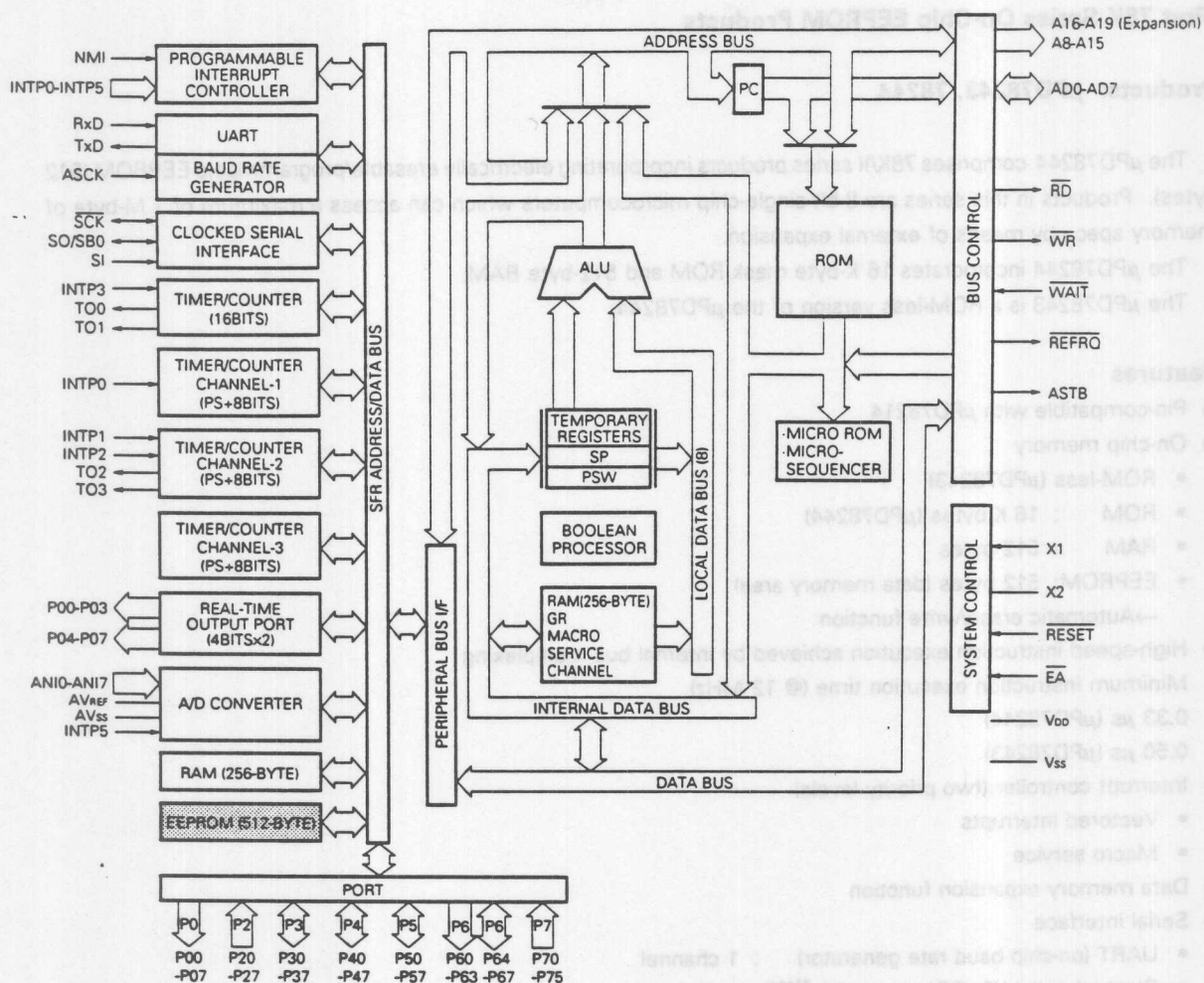
- Pin-compatible with μ PD78214
- On-chip memory
 - ROM-less (μ PD78243)
 - ROM : 16 K bytes (μ PD78244)
 - RAM : 512 bytes
 - EEPROM: 512 bytes (data memory area)
 - Automatic erase/write function
- High-speed instruction execution achieved by internal bus multiplexing
Minimum instruction execution time (@ 12 MHz)
0.33 μ s (μ PD78244)
0.50 μ s (μ PD78243)
- Interrupt controller (two priority levels)
 - Vectored interrupts
 - Macro service
- Data memory expansion function
- Serial interface
 - UART (on-chip baud rate generator) : 1 channel
 - Clocked serial I/O (SBI compatible^{Note}): 1 channel
- I/O pins: 54 (μ PD78244), 36 (μ PD78243)
 - On-chip software-specifiable pull-up resistor (34 pins)
 - LED direct drive capability (16 pins)
 - Transistor direct drive capability (8 pins)
- Real-time output ports
Capable of independent control of 2 stepping motor systems
- A/D converter (8 analog inputs)
- High-performance timer/counters
16 bits \times 1 channel, 8 bits \times 3 channels

Note NEC standard serial bus interface

Application Field

Cameras, electronic musical instruments, facsimile machines, printers, air conditioners, etc.
(In particular, control of equipment requiring data retention in the event of a power failure.)

Block Diagram



Remark Internal ROM capacity depends on the product.

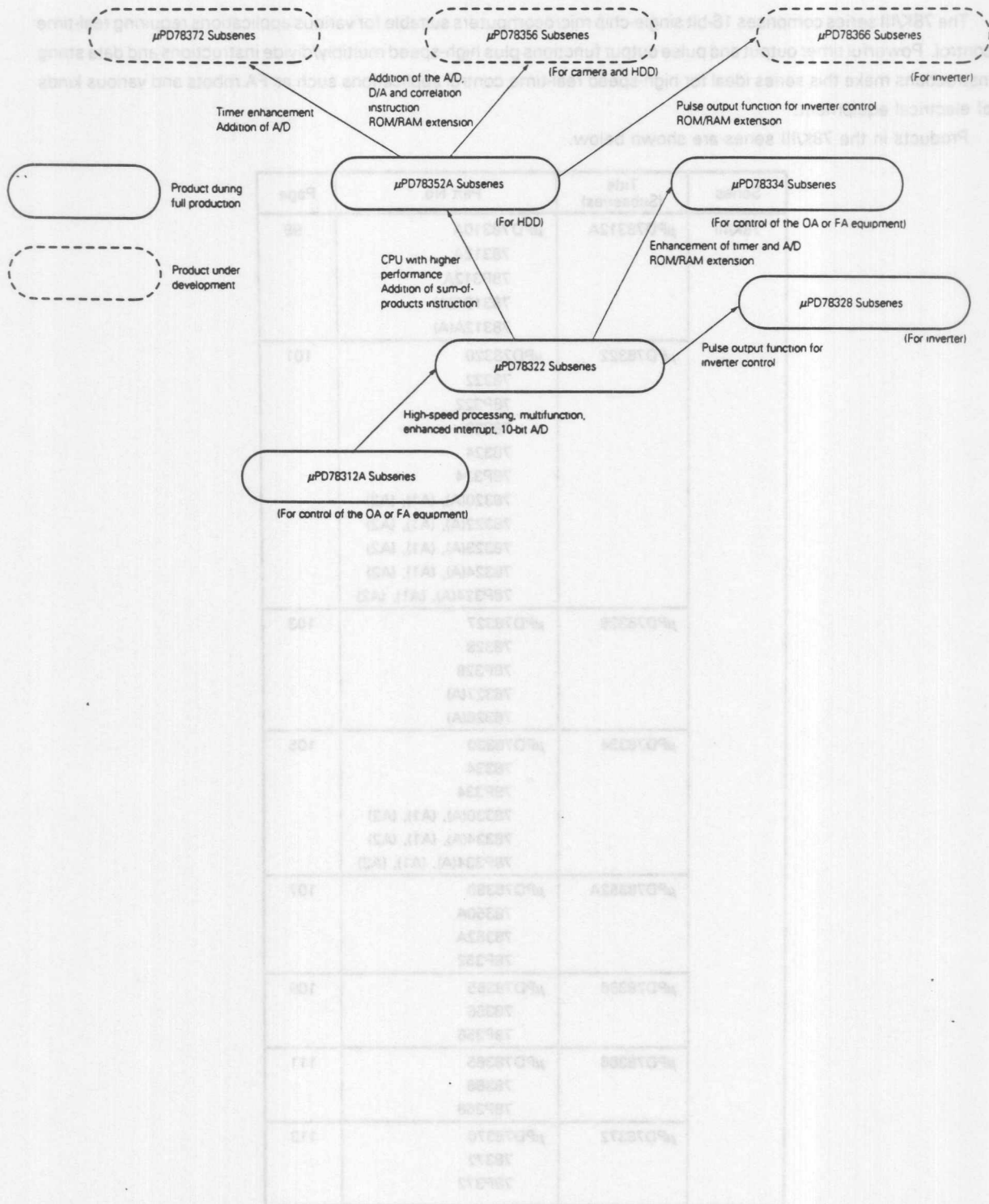
4.6 78K/III Series

The 78K/III series comprises 16-bit single-chip microcomputers suitable for various applications requiring real-time control. Powerful timer output and pulse output functions plus high-speed multiply/divide instructions and data string instructions make this series ideal for high-speed real-time control applications such as FA robots and various kinds of electrical equipment.

Products in the 78K/III series are shown below.

Series	Title (Subseries)	Part No.	Page
78K/III	μ PD78312A	μ PD78310A 78312A 78P312A 78310A(A) 78312A(A)	99
	μ PD78322	μ PD78320 78322 78P322 78323 78324 78P324 78320(A), (A1), (A2) 78322(A), (A1), (A2) 78323(A), (A1), (A2) 78324(A), (A1), (A2) 78P324(A), (A1), (A2)	101
	μ PD78328	μ PD78327 78328 78P328 78327(A) 78328(A)	103
	μ PD78334	μ PD78330 78334 78P334 78330(A), (A1), (A2) 78334(A), (A1), (A2) 78P334(A), (A1), (A2)	105
	μ PD78352A	μ PD78350 78350A 78352A 78P352	107
	μ PD78356	μ PD78355 78356 78P356	109
	μ PD78366	μ PD78365 78366 78P368	111
	μ PD78372	μ PD78370 78372 78P372	113

78K/III Series Product Development



4.6.1 μ PD78312A

Enhanced Computing Power and Interrupt Service Functions

Products: μ PD78310A, 78312A, 78P312A, 78310A(A), 78312A(A)

The μ PD78312A is a 16-/8-bit microcomputer with greatly improved internal computing power incorporating a high-performance 16-bit CPU. Memory can be expanded externally up to 56 K bytes.

The μ PD78310A is a ROM-less version of the μ PD78312A, capable of direct accessing of up to 64 K bytes of external memory.

The μ PD78P312A, incorporating one-time PROM or EPROM, is suitable for short-run and multiple-device production or system evaluation.

The μ PD78310A(A), 78312A(A) are "Special" quality grade versions of the μ PD78310A, 78312A, respectively.

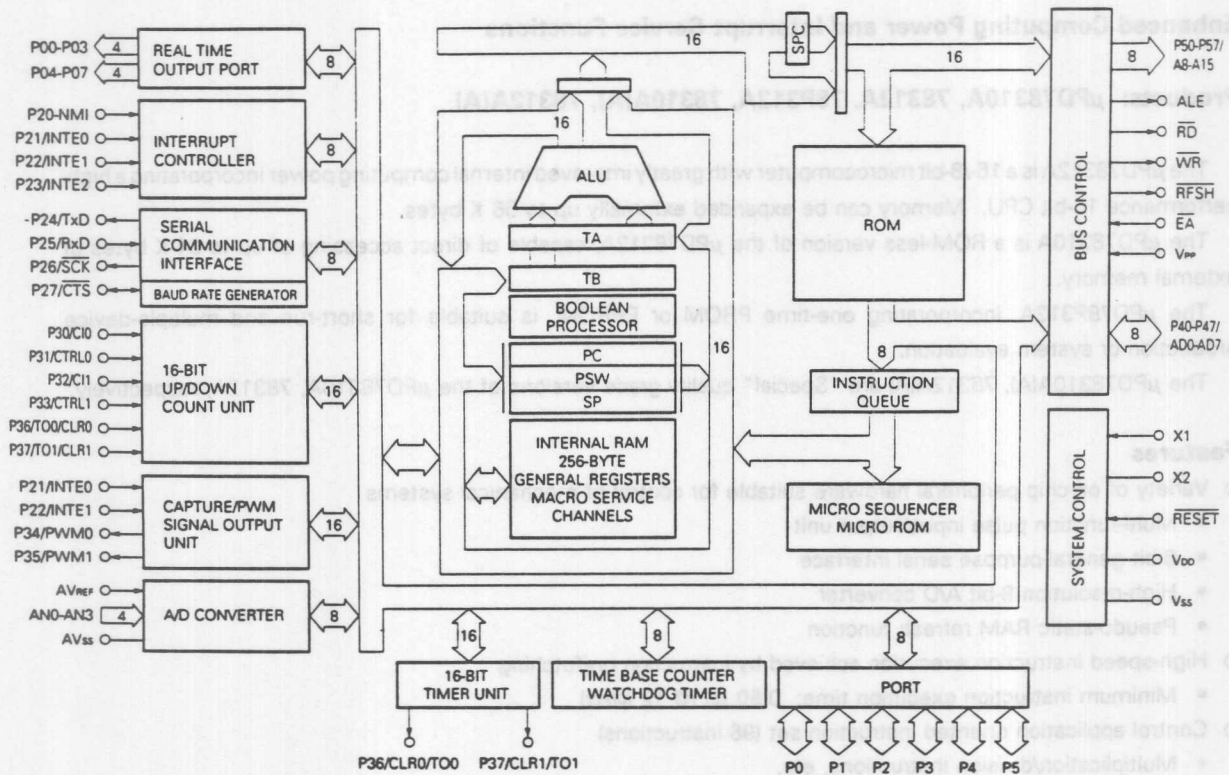
Features

- Variety of on-chip peripheral hardware suitable for control of mechanical systems
 - Multi-function pulse input/output unit
 - 8-bit general-purpose serial interface
 - High-resolution 8-bit A/D converter
 - Pseudo-static RAM refresh function
- High-speed instruction execution achieved by instruction prefetching
 - Minimum instruction execution time: 0.50 μ s (@ 12 MHz)
- Control application oriented instruction set (96 instructions)
 - Multiplication/division instructions, etc.
(16 bits \times 16 bits, 32 bits \div 16 bits)
- On-chip high-performance interrupt controller
 - Three interrupt servicing
(Vectored interrupts, macro service, context switching)

Application Field

- Standard products: Control equipment for DC servo motors, stepping motors, etc.
- Special products: Automotive electrical equipment

Block Diagram



- Remarks**
1. Internal ROM capacity depends on the product.
 2. V_{PP} for the μPD78P312A.

4.6.2 μ PD78322

On-Chip 10-Bit A/D Converter, Oriented toward High-Performance Pulse Control

Products: μ PD78320, 78322, 78P322, 78323, 78324, 78P324,
 μ PD78320(A), (A1), (A2), 78322(A), (A1), (A2),
 μ PD78323(A), (A1), (A2), 78324(A), (A1), (A2),
 μ PD78P324(A), (A1), (A2)

The μ PD78322 is a 16-/8-bit single-chip microcomputer which incorporates a high-performance 16-bit CPU.

The μ PD78322 and μ PD78324 have on-chip 16 K-byte and 32 K-byte mask ROM, and the μ PD78320, 78323 are ROM-less products. In the μ PD78P322 and μ PD78P324, the on-chip mask ROM of the μ PD78322 and μ PD78324 are replaced with one-time PROM or EPROM, respectively.

The μ PD78320(A), (A1), (A2) and μ PD78322(A), (A1), (A2) are "Special" quality grade versions of the μ PD78320 and μ PD78322, respectively. The μ PD78323(A), (A1), (A2), μ PD78324(A), (A1), (A2), μ PD78P324(A), (A1), (A2) are "Special" quality grade versions of the μ PD78323, 78324 and 78P324, respectively.

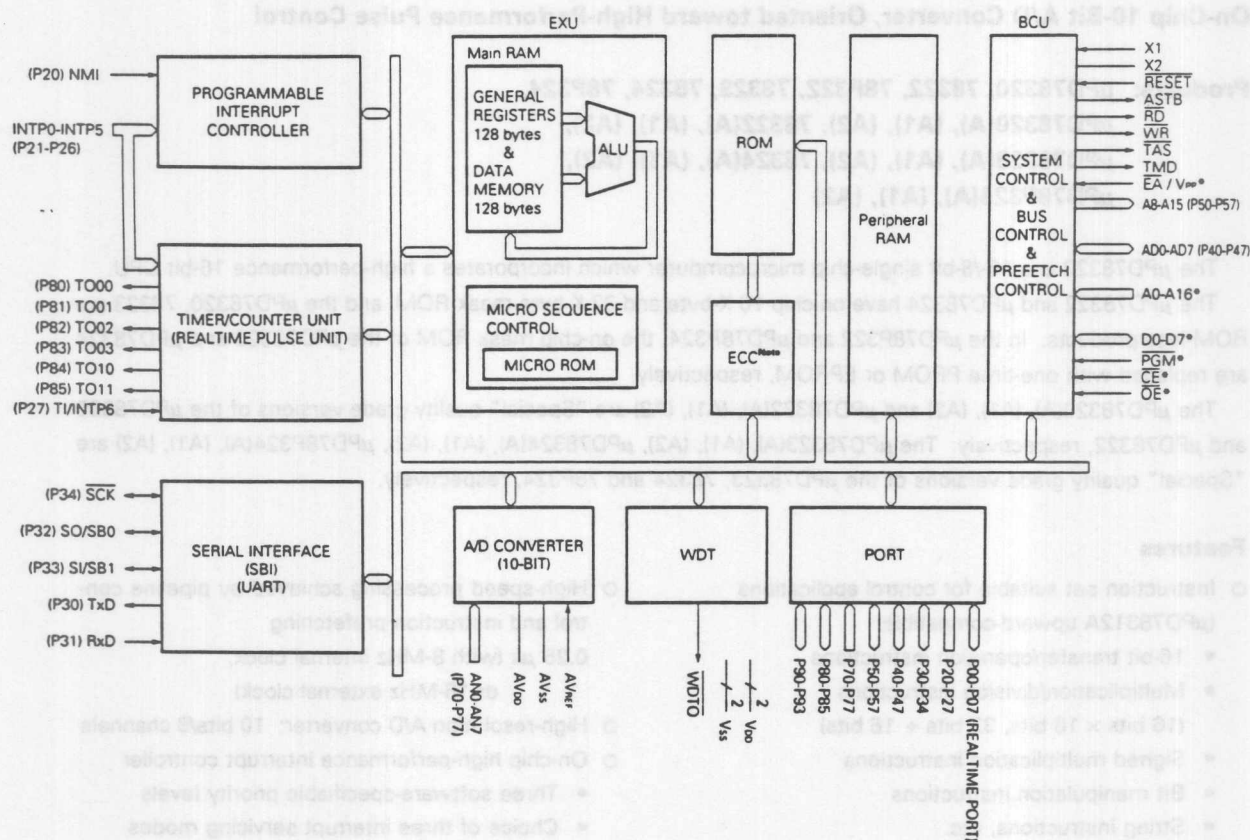
Features

- Instruction set suitable for control applications (μ PD78312A upward-compatible)
 - 16-bit transfer/operation instructions
 - Multiplication/division instructions (16 bits \times 16 bits, 32 bits \div 16 bits)
 - Signed multiplication instructions
 - Bit manipulation instructions
 - String instructions, etc.
- On-chip ROM : None (μ PD78320, 78323)
16 K bytes (μ PD78322)
32 K bytes (μ PD78324)
- On-chip PROM: 16 K bytes (μ PD78P322)
32 K bytes (μ PD78P324)
 - Programmable once only (Windowless one-time PROM product)
 - Ultraviolet erasable, electrically programmable (EPROM with window)
- On-chip RAM: 640 bytes (μ PD78320, 78322, 78P322)
1024 bytes (μ PD78323, 78324, 78P324)
- High-speed processing achieved by pipeline control and instruction prefetching
0.25 μ s (with 8-MHz internal clock,
or 16-MHz external clock)
- High-resolution A/D converter: 10 bits/8 channels
- On-chip high-performance interrupt controller
 - Three software-specifiable priority levels
 - Choice of three interrupt servicing modes (Vectored interrupts/macro service/context switching)
- Variety of peripheral hardware
 - Real-time pulse unit
 - Two general-purpose serial interface channels
 - Watchdog timer
- Turbo Access Manager control signal output function

Application Field

- Standard products: Fields dealing with motor control equipment, etc.
- Special products: Automotive electrical equipment, including engine control, antiskid control, etc.

Block Diagram



Note ECC circuit is incorporated only in the μ PD78P324.

Remarks 1. Internal ROM, RAM capacity depends on the product.

2. *: In PROM programming mode. (excluding EA)

4.6.3 μ PD78328

On-Chip 6-Phase PWM Output Function, Ideal for Inverter Control

Products: μ PD78327, 78328, 78P328, 78327(A), 78328(A)

The μ PD78328 is a 78K/III series product incorporating a high-performance 16-bit CPU. The μ PD78322 real-time pulse unit PWM signal output functions have been incorporated, with enhancements for inverter control in particular.

The μ PD78327 is a ROM-less version of the μ PD78328.

The μ PD78P328 has the on-chip mask ROM of the μ PD78328 replaced with one-time PROM or EPROM.

The μ PD78327(A), 78328(A) are "Special" quality grade versions of the μ PD78327, 78328, respectively.

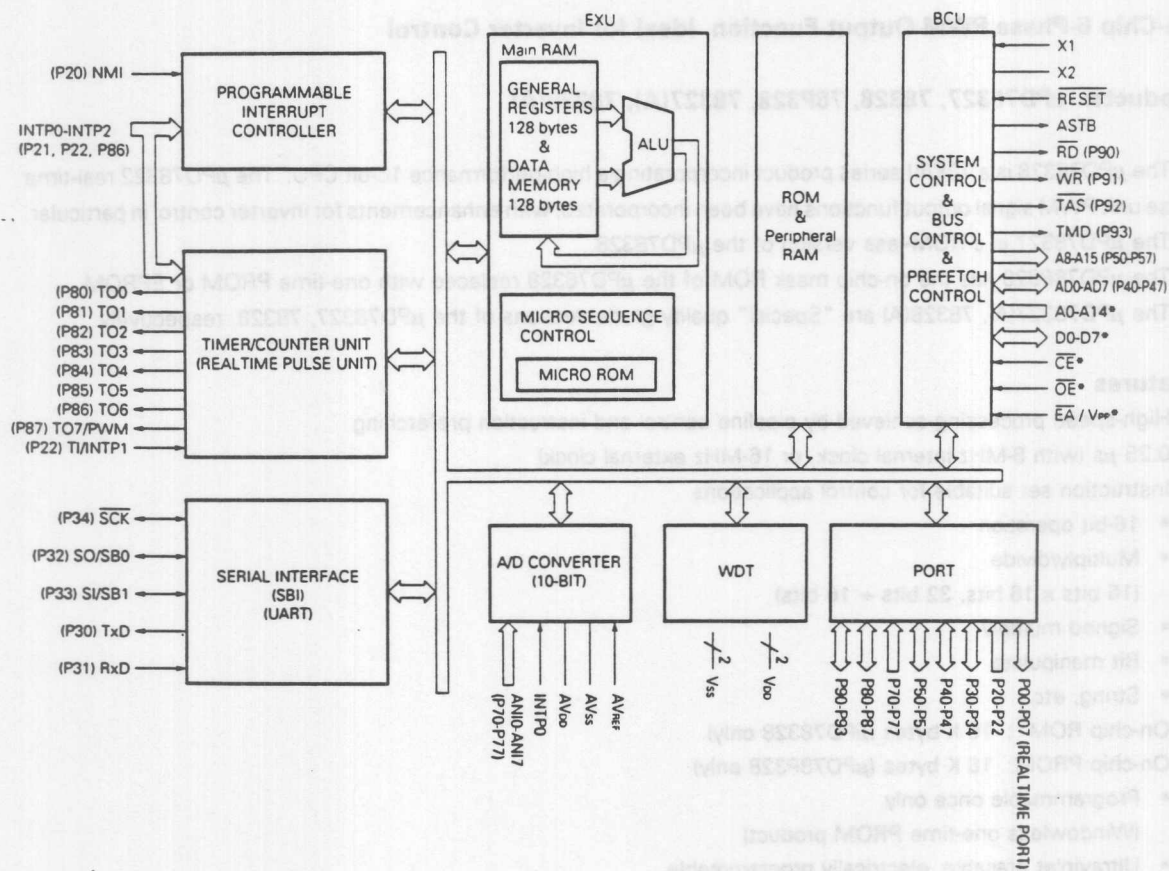
Features

- High-speed processing achieved by pipeline control and instruction prefetching
0.25 μ s (with 8-MHz internal clock, or 16-MHz external clock)
- Instruction set suitable for control applications
 - 16-bit operation
 - Multiply/divide
(16 bits \times 16 bits, 32 bits \div 16 bits)
 - Signed multiply
 - Bit manipulate
 - String, etc.
- On-chip ROM : 16 K bytes (μ PD78328 only)
- On-chip PROM: 16 K bytes (μ PD78P328 only)
 - Programmable once only
(Windowless one-time PROM product)
 - Ultraviolet erasable, electrically programmable
(EPROM with window)
- On-chip RAM: 512 bytes
- Real-time pulse unit suitable for inverter control
 - Choice of two timer output modes
(6 set/reset outputs/8 buffer outputs)
 - Easy output of 6-phase PWM signal
- High-resolution A/D converter: 10 bits / 8 channels
- High-speed 8-bit PWM signal output function: 1 channel
- On-chip high-performance interrupt controller
 - Three software-specifiable priority levels
 - Choice of three interrupt servicing modes
(Vectored interrupts/macro service/context switching)
- Watchdog timer function for detection of inadvertent program looping
- Turbo Access Manager control output function

Application Field

- Standard products: PWM inverter control equipment including inverter air conditioners, etc.
- Special products: Automotive electrical equipment

Block Diagram



- Remarks**
1. Internal ROM capacity depends on the product.
 2. *: In PROM programming mode. (excluding EA)

4.6.4 μ PD78334

On-Chip Large-Capacity Memory and Various Pulse Output Functions

Products: μ PD78330, 78334, 78P334, 78330(A), (A1), (A2), 78334(A), (A1), (A2), 78P334(A), (A1), (A2)

The μ PD78334 is a 78K/III series product incorporating a high-performance 16-bit CPU. The μ PD78322 real-time pulse unit functions have been enhanced, and on-chip memory capacity has been greatly expanded. This product is ideal for application areas with an emphasis on real-time pulse control, such as DC servo motor control, etc.

The μ PD78330 ROM-less version and μ PD78P334 on-chip PROM version are also available.

The μ PD78330(A), (A1), (A2), μ PD78334(A), (A1), (A2), μ PD78P334(A), (A1), (A2) are "Special" quality grade versions of the μ PD78330, 78334 and 78P334, respectively.

Features

- High-speed processing achieved by pipeline control and instruction prefetching
0.25 μ s (with 8-MHz internal clock, or 16-MHz external clock)
- Instruction set suitable for control applications
 - 16-bit operation
 - Multiply/divide
(16 bits \times 16 bits, 32 bits \div 16 bits)
 - Signed multiply
 - Bit manipulate
 - String, etc.
- Powerful real-time pulse unit
 - 18-/16-bit timer/counter \times 1
 - 16-bit timer/counter \times 3
- On-chip high-resolution A/D converter: 10 bits / 16 channels
- 2 independent serial interface channels
 - UART
 - Clocked serial interface/SBI^{Note}
- On-chip high-performance interrupt controller
 - Three software specifiable priority levels
 - Choice of three interrupt servicing modes
(Vectored interrupt function/context switching function/macro service function)
- High-precision PWM signal output function: 2 channels
- Watchdog timer function for detection of inadvertent program looping

Note NEC standard serial bus interface

Application Field

- Standard products: FA field, etc.
- Special products: Automotive electrical equipment

4.6.5 μ PD78352A

On-Chip High-Speed Sum-of-Products Operation Function, Ideal for ASIC Control

Products: μ PD78350, 78350A, 78352A, 78P352

The μ PD78352A is a 78K/III series 16-/8-bit single-chip microcomputer popular in a real-time control application field.

This microcomputer incorporates only the hardware required for use as an ASIC controller, in order to allow original application systems to be developed in combination with an ASIC. Computational functions have been enhanced by the addition of sum-of-products operation instructions, making the μ PD78352A suitable for use in a wide range of application areas as a high-speed, simple CPU.

The μ PD78350 also supports the external 25-MHz operation mode.

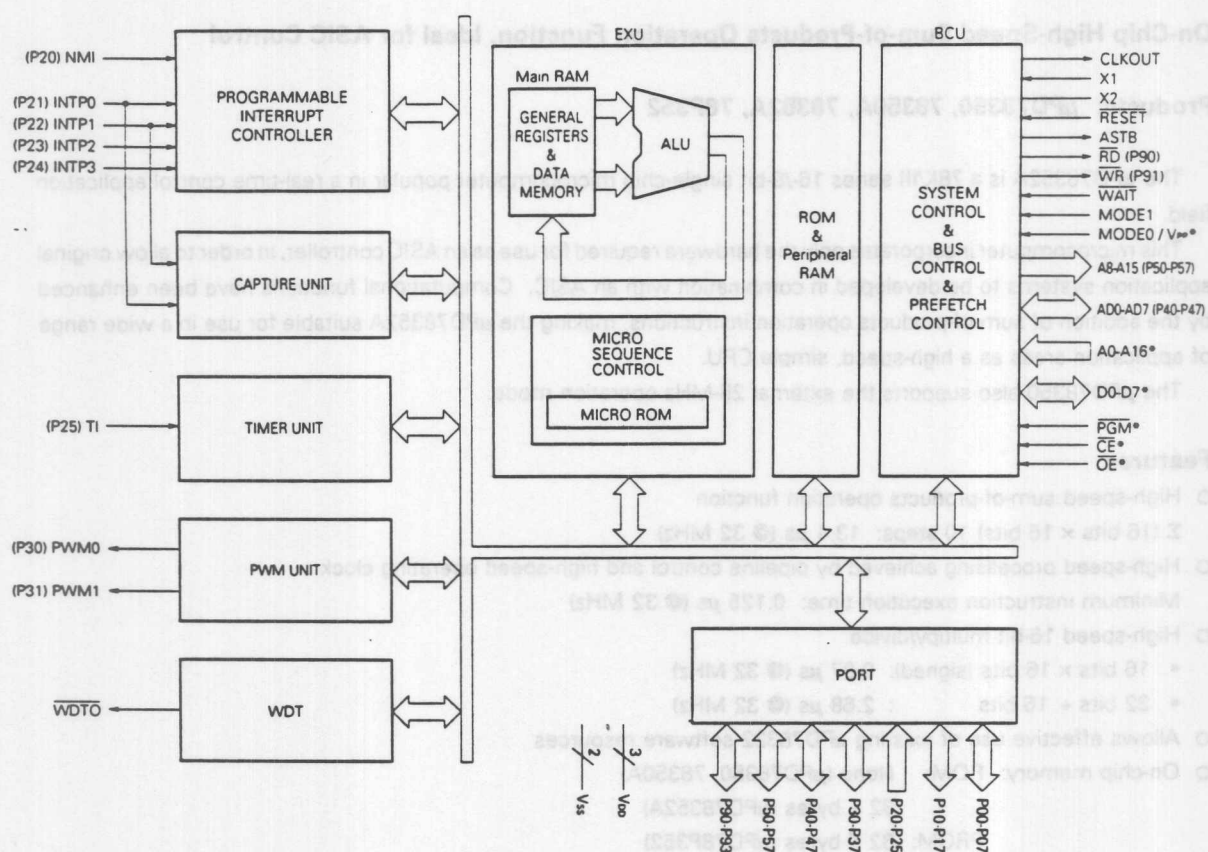
Features

- High-speed sum-of-products operation function
 Σ (16 bits \times 16 bits) 10 steps: 13.4 μ s (@ 32 MHz)
- High-speed processing achieved by pipeline control and high-speed operating clock
Minimum instruction execution time: 0.125 μ s (@ 32 MHz)
- High-speed 16-bit multiply/divide
 - 16 bits \times 16 bits (signed): 0.87 μ s (@ 32 MHz)
 - 32 bits \div 16 bits : 2.68 μ s (@ 32 MHz)
- Allows effective use of existing μ PD78322 software resources
- On-chip memory: ROM: None (μ PD78350, 78350A)
32 K bytes (μ PD78352A)
PROM: 32 K bytes (μ PD78P352)
RAM: 640 bytes
- Capability of bus cycle wait control from off chip: external wait pin
- Timer unit
 - 16-bit timers \times 3
 - 16-bit capture registers \times 2
 - 16-bit compare registers \times 2
 - 8-bit resolution PWM outputs \times 2

Application Field

- OA field including HDD & FDD control, etc.
- FA field, etc.

Block Diagram



- Remarks**
1. Internal ROM capacity depends on the product.
 2. *: In PROM programming mode. (excluding MODE0)
 3. μ PD78350 does not have a $\overline{\text{WAIT}}$ pin.

4.6.6 μ PD78356 (Preliminary)

Microcomputer for Control with On-Chip High-Speed A/D and D/A, Equipped with Sum-of-Products Operation Function

Products: μ PD78355, 78356, 78P356

The μ PD78356 is a product in which correlation instruction is added to the μ PD78352A of the same 78K/III series and operation functions are enhanced. A wide range of application use as high-speed CPU is possible.

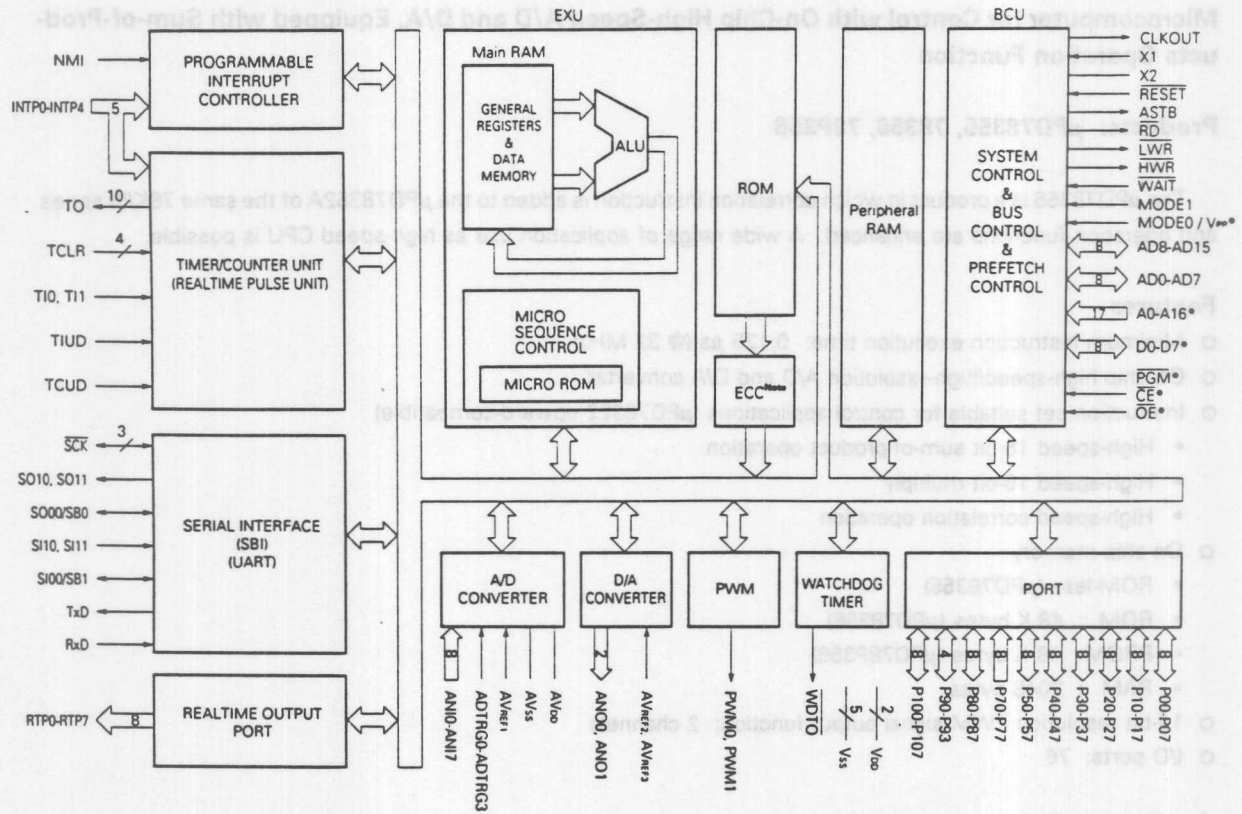
Features

- Minimum instruction execution time: 0.125 μ s (@ 32 MHz)
- On-chip high-speed/high-resolution A/D and D/A converter
- Instruction set suitable for control applications (μ PD78322 upward-compatible)
 - High-speed 16-bit sum-of-product operation
 - High-speed 16-bit multiply
 - High-speed correlation operation
- On-chip memory
 - ROM-less (μ PD78355)
 - ROM : 48 K bytes (μ PD78356)
 - PROM: 48 K bytes (μ PD78P356)
 - RAM : 2048 bytes
- 12-bit resolution PWM signal output function: 2 channels
- I/O ports: 76

Application Field

- HDD, video camcorders, single-lens reflex cameras, etc.

Block Diagram



Note ECC circuit is incorporated only in the μ PD78P356.

- Remarks**
1. Internal ROM capacity depends on the product.
 2. *: In PROM programming mode. (excluding MODE0)

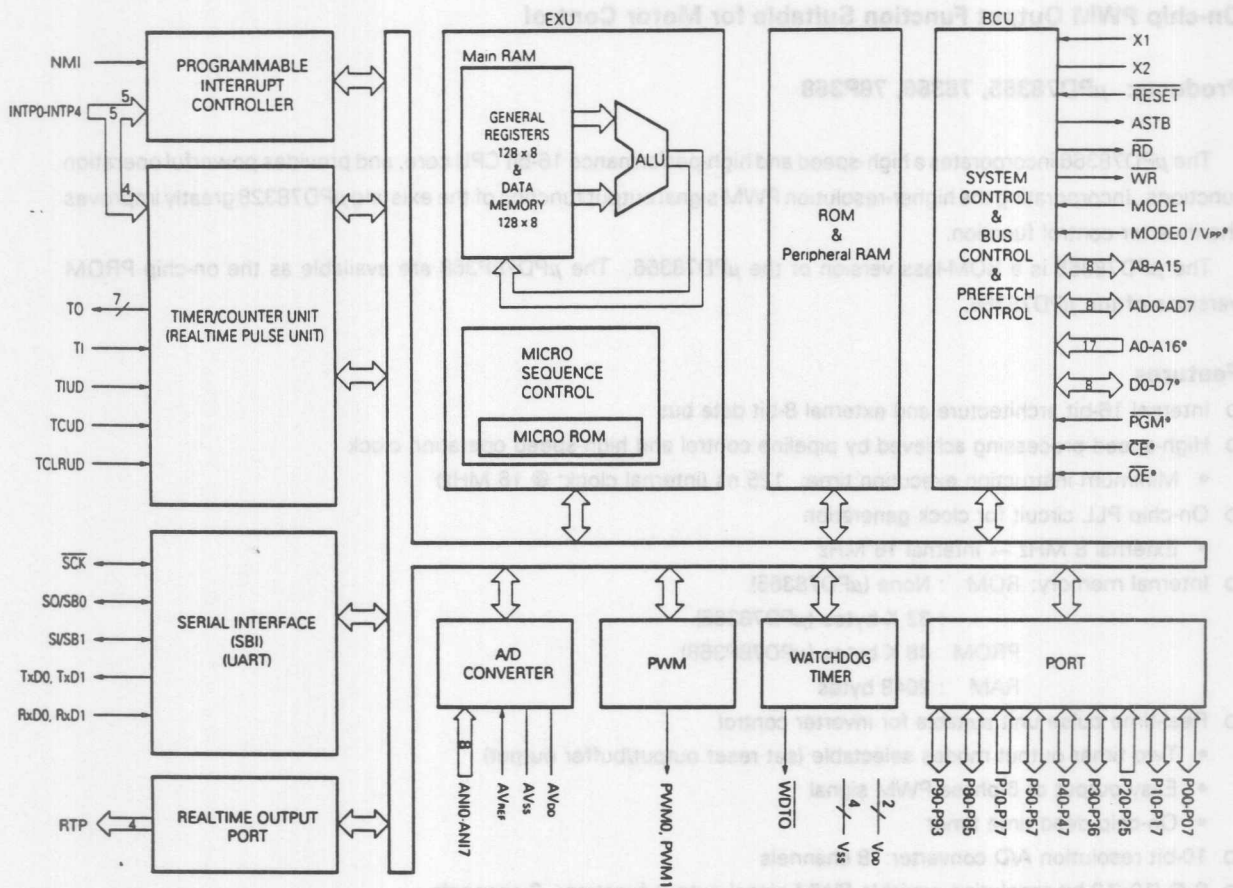
Products: μ PD78365, 78366, 78P368

The μ PD78365 is a ROM-less version of the μ PD78366. The μ PD78P368 are available as the on-chip PROM versions of the μ PD78366.

- Internal 16-bit architecture and external 8-bit data bus
- High-speed processing achieved by pipeline control and high-speed operation clock
 - Minimum instruction execution time: 125 ns (internal clock: @ 16 MHz)
- On-chip PLL circuit for clock generation
 - External 8 MHz → Internal 16 MHz
- Internal memory: ROM : None (μ PD78365)
 - : 32 K bytes (μ PD78366)
 - PROM 48 K bytes (μ PD78P368)
 - RAM : 2048 bytes
- Real-time pulse unit suitable for inverter control
 - Two timer output modes selectable (set reset output/buffer output)
 - Easy output of 6-phase PWM signal
 - On-chip dead time timer
- 10-bit resolution A/D converter: 8 channels
- 8/9/10/12-bit resolution, variable PWM signal output function: 2 channels
- Powerful serial interface: 2 channels

- Inverter air conditioners
- FA equipment including robots, machine tools, etc.

Block Diagram



- Remarks**
1. Internal ROM, RAM capacity depends on the product.
 2. *: In PROM programming mode

4.6.8 μ PD78372 (Preliminary)

Many Timer Outputs and Suitable for Motor Control

Products: μ PD78370, 78372, 78P372

The μ PD78372 has a high-speed and high-performance 16-bit CPU with an excellent operating capability. It has a real-time pulse unit and A/D converter which are necessary for the real-time control of pulses for motor control. It also has a bus sizing function: 8-bit data bus or 16-bit data bus, switchable.

The μ PD78370 is ROM-less version of the μ PD78372. The μ PD78P372 is the on-chip PROM version.

Features

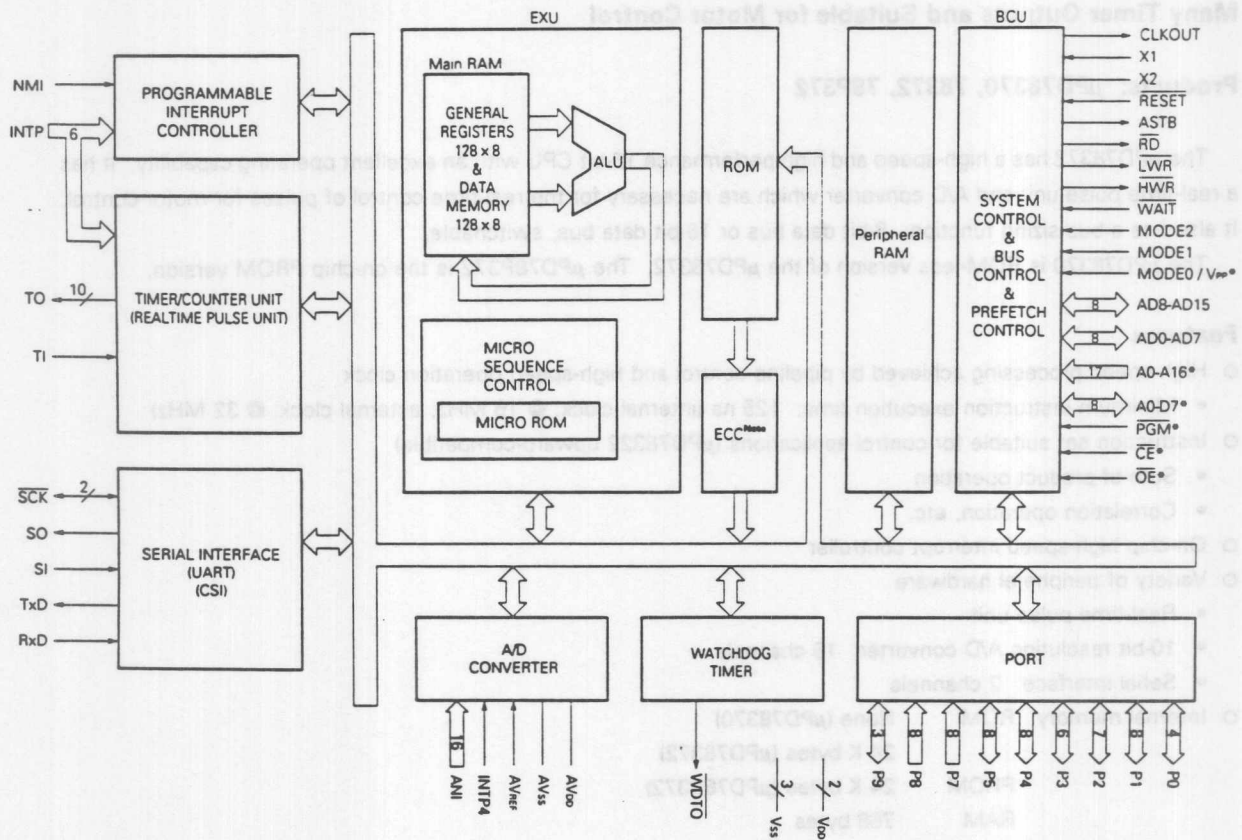
- High-speed processing achieved by pipeline control and high-speed operation clock
 - Minimum instruction execution time: 125 ns (internal clock: @ 16 MHz, external clock: @ 32 MHz)
- Instruction set suitable for control applications (μ PD78322 upward-compatible)
 - Sum-of-product operation
 - Correlation operation, etc.
- On-chip high-speed interrupt controller
- Variety of peripheral hardware
 - Real-time pulse unit
 - 10-bit resolution A/D converter: 16 channels
 - Serial interface: 2 channels
- Internal memory: ROM None (μ PD78370)
 24 K bytes (μ PD78372)
 PROM 24 K bytes (μ PD78P372)
 RAM 768 bytes

Application Field

- OA field including PPC and printer, etc.
- FA equipment including robots, machine tools, etc.

Remark "Special" quality grade μ PD78370(A), 78372(A), and 78P372(A) are available for the automobile use.

Block Diagram



Note ECC circuit is incorporated only in the μ PD78P372.

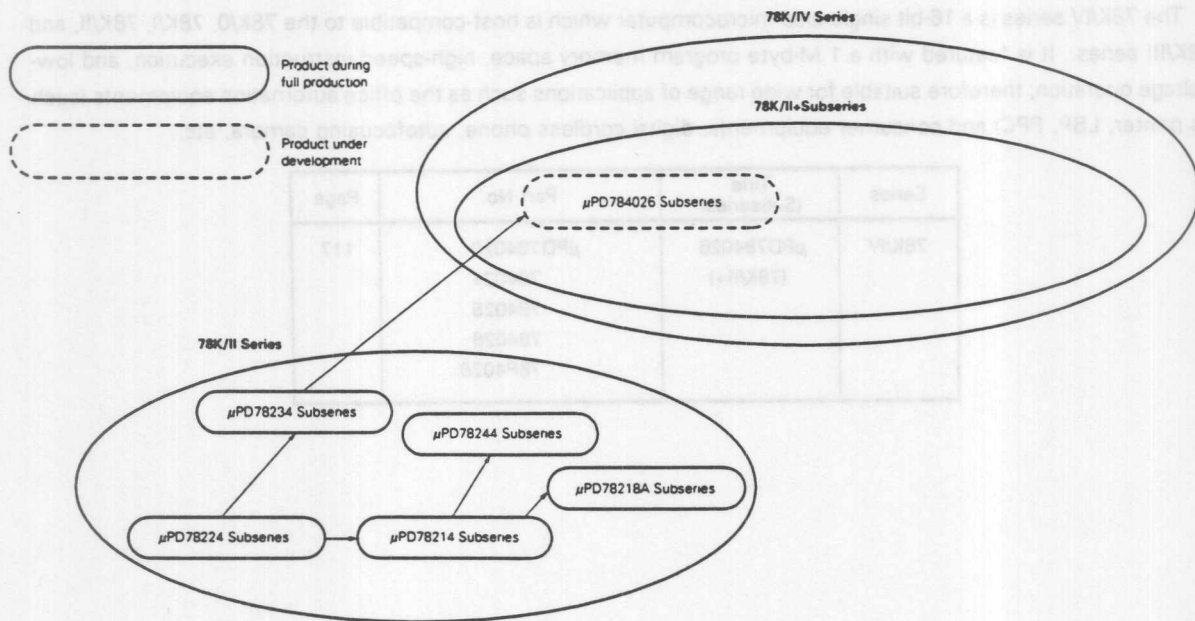
- Remarks**
1. Internal ROM capacity depends on the product.
 2. *: In PROM programming mode. (excluding MODE0)

4.7 78K/IV Series

The 78K/IV series is a 16-bit single-chip microcomputer which is host-compatible to the 78K/0, 78K/I, 78K/II, and 78K/III series. It is featured with a 1 M-byte program memory space, high-speed instruction execution, and low-voltage operation; therefore suitable for wide range of applications such as the office automation equipments (such as printer, LBP, PPC) and consumer equipments, digital cordless phone, autofocus camera, etc.

Series	Title (Subseries)	Part No.	Page
78K/IV	μ PD784026 (78K/II+)	μ PD784020 784021 784025 784026 78P4026	117

78K/II+ Subseries Product Development



4.7.1 μ PD784026 (Preliminary)

Analog I/O

Products: μ PD784020, 784021, 784025, 784026, 78P4026

The μ PD784026 is a host compatible type of the μ PD78234. Its operating speed is two-times higher than that of the μ PD78234, with improved timer/counter (16 bits), on-chip memory capacity (expanded), and instruction set.

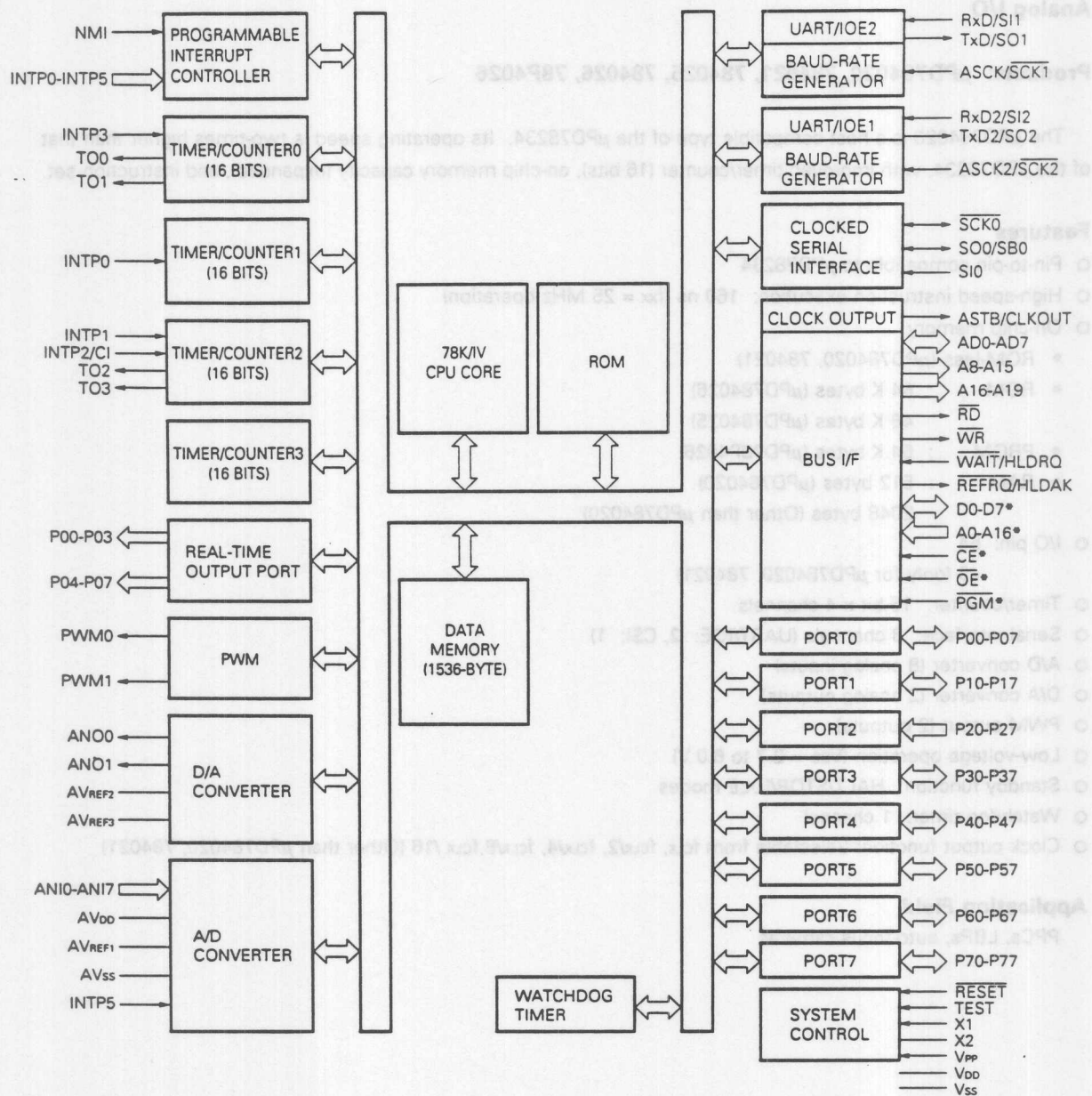
Features

- Pin-to-pin compatible to μ PD78234
- High-speed instruction execution: 160 ns ($f_{\text{ox}} = 25$ MHz operation)
- On-chip memory
 - ROM-less (μ PD784020, 784021)
 - ROM : 64 K bytes (μ PD784026)
48 K bytes (μ PD784025)
 - PROM : 64 K bytes (μ PD78P4026)
 - RAM : 512 bytes (μ PD784020)
2048 bytes (Other than μ PD784020)
- I/O pin: 64
46 (only for μ PD784020, 784021)
- Timer/counter: 16-bit \times 4 channels
- Serial interface: 3 channels (UART/IOE: 2, CSI: 1)
- A/D converter (8 analog inputs)
- D/A converter (2 analog outputs)
- PWM output (2 outputs)
- Low-voltage operation ($V_{\text{DD}} = 2.7$ to 6.0 V)
- Standby function: HALT/STOP/IDLE modes
- Watchdog timer: 1 channel
- Clock output function: Selectable from f_{CLK} , $f_{\text{CLK}}/2$, $f_{\text{CLK}}/4$, $f_{\text{CLK}}/8$, $f_{\text{CLK}}/16$ (Other than μ PD784020, 784021)

Application Field

PPCs, LBPs, auto-focus cameras

Block Diagram



- Remarks**
1. Internal ROM and RAM capacity depends on the product.
 2. V_{PP} for the μPD78P4026.
 3. *: In PROM programming mode.

5. DEVELOPMENT TOOLS AND EVALUATION TOOLS

The following support tools are available for application system development and evaluation using the 78 K series.

5.1 Development Tools

The following support tools are available for application system program development.

Table 5-1. Development Tools and Functions (1/2)

Development Tool		Function
Hardware	In-circuit emulator (IE-78xxx-R) (IE-78xxx-R-A) (IE-78xxx-R)	Development tool used for hardware and program debugging in 78K series application system development. Using a personal computer (PC-9800 series or IBM PC/AT™) as the host machine allows efficient debugging by means of functions for symbolic debugging and object file and symbol file transfer. An RS-232-C serial interface is incorporated, allowing a PROM programmer (PG-1500, etc.) to be connected.
	Break board (IE-78200-R-BK) (IE-78330-R-BK) (IE-78350-R-BK) (IE-78000-R-BK) (IE-784000-R-BK)	Board used for in-circuit emulator (IE) event setting. Normally incorporated in the IE unit. This board may need to be changed in an IE system upgrade (change of products to be debugged) (see Table 5-2 Development Tool System Upgrades).
	Emulation board (IE-78xxx-R-EM) (IE-78xxx-R-EM)	Board for emulating different peripheral hardware for each target device. Normally incorporated in the IE unit. This board may need to be changed in an IE system upgrade (change of devices to be debugged) to suit the device concerned (see Table 5-2 Development Tool System Upgrades).
	I/O emulation board (IE-78xxx-R-EM1) (IE-78xxx-R-EM1)	Board for emulating different peripheral hardware for each target device. Used with the emulation board. Target device which requires the I/O emulation board depends on each product. (See 5.4.1 (4) List of 78K/III series tools and (5) List of 78K/IV series tools).

Table 5-1. Development Tools and Functions (2/2)

Development Tool		Function
Hardware	Emulation probe (EP-78xxx...)	Probe for connecting the application system to the IE. A probe is available for each target device package.
	Conversion socket (EV-9200xx-xx)	Socket for connection of a QFP emulation probe to the application system. Supplied with the QFP emulation probe. Mounted on the application system board.
	Conversion adapter (EV-9500xx-xx)	Conversion adapter for the QFP. Used by mounting it on the user system board.
	Conversion adapter (EV-9501GC-100)	Conversion adapter used by connecting it to the emulation probe for the 120-pin QFP. Used for the 120-to-100 pin conversion.
	Programmer adapter (PA-78Pxxx...)	PROM programmer (PG-1500) adapter used when programming an on-chip PROM product. An adapter is available for each target device package.
Jig (EV-9900)		Jig used for WQFN package product removal from EV-9200xx-xx.
Software	Screen debugger ^{Note 1}	Program to control an in-circuit emulator for 78K/0 series, 78K/II series or 78K/IV series. Used in combination with the device file. This enables more efficient debugging than a conventional IE controller by debugging in the level of source program written in C language, structured assembly language or assembly language, and by displaying various kinds of information at the same time on divided screens of the host machine.
	Device file	Use in combination with the screen debugger. This is necessary for debugging of 78K/0 series, 78K/II series or 78K/IV series.
	In-circuit emulator control program (IE controller)	Software for efficient debugging by connecting the IE to a host machine. Makes full use of IE functions such as file transfer (object/symbol files), on-line assembly, disassembly, break condition (event) setting, etc.
	Relocatable assembler ^{Note 2}	Program which converts a program written in mnemonics to object code which can be executed by a microcomputer. Also provided with functions for automatically performing symbol table creation, branch instruction optimization processing, etc.
	Structured assembler preprocessor	Incorporates structured programming in an assembler. Allows coding of C language type control structures without sacrificing the speed and compactness of an assembler.
	C compiler ^{Note 2}	Program which converts a program written in the high-level language C to object code which can be executed by a microcomputer.
	C library source	Library source programs provided with the C compiler. Necessary for library improvement (to match user specifications more closely).
	System simulator for 78K/0 series (SM78K/0) ^{Note 3, 4}	Software development support tool for 78K/0 series. It enables debugging on the C source level or assembler level while simulating the operations of the target system on a host machine. By using the SM78K/0, the logic of application software and performance can be verified separately from hardware development and development efficiency and software quality can be improved.

Notes 1. This is called "Integrated debugger" in the 78K/IV series.

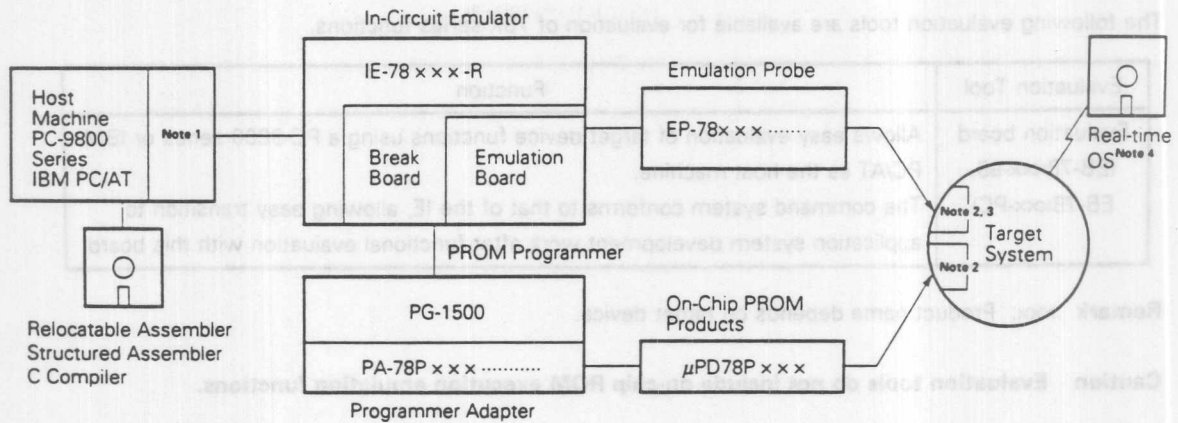
2. 78K/0 and 78K/IV series are used in combination with device files.

3. Used in combination with device files

4. Under development

Remark All software is supported on MS-DOSTM and PC DOSTM operating systems.

Figure 5-1. Development Tool Configuration



Notes 1. 78K/0, 78K/II series: Screen debugger, device file

78K/I, 78K/III series: IE controller

78K/IV series: Integrated debugger, device file

2. Conversion socket for connecting QFP emulation probe to user system (product with product name beginning with "EV-9200").

3. EV-9500xx-xx

4. For the target device of the real-time OS, see section 5.4.2 **List of software tools**.

Remark Symbols denote product names as follows:

IE : In-circuit emulator

EP : Emulation probe

PA : PROM programmer adapter

xxx...: Product name depends on the target device and package.

5.2 Evaluation Tools

The following evaluation tools are available for evaluation of 78K series functions.

Evaluation Tool	Function
Evaluation board (EB-78xxx-98, EB-78xxx-PC)	Allows easy evaluation of target device functions using a PC-9800 series or IBM PC/AT as the host machine. The command system conforms to that of the IE, allowing easy transition to application system development work after functional evaluation with this board.

Remark xxx: Product name depends on target device.

Caution Evaluation tools do not include on-chip ROM execution emulation functions.

5.3 Software for Integration

The following integration programs are available for programming and maintenance.

Integration software	Functions
Real-time OS (RX78K series)	Versatile real-time OS developed for 78K/0 series, 78K/II series, 78K/III series, and 78K/IV series. By using the RX78K series, the program can be maintained, managed, and used for each function, and so application programs can be developed efficiently. The RX78K series complies with the μ TRON OS which is standardized for being incorporated into the single-chip microcomputers. It offers the μ TRON-specified system call to realize the real-time, multitask processing and thus expands the application range of the system.
(MX78K/0) ^{Note}	OS developed for the 78K/0 series. The MX78K/0 is a simplified version of the RX78K/0, with less memories. The MX78K series is featured with task management, event management, and time management; and controls the task execution sequence and switching to the next task to be executed.
Fuzzy inference development support system	Support tool for design to simulation of the fuzzy inference knowledge to be incorporated into the single-chip microcomputers made of 78K/0 series, 78K/II series, and 78K/III series. Graphics is fully used for visualization of data for efficient development.
Fuzzy knowledge data creation tool	Support program for the input/editing and simulation of fuzzy knowledge data (fuzzy rule and membership function)
Translator	Program which converts the fuzzy knowledge data obtained by the fuzzy knowledge data creation tool to the assembler source program for the RA78K/0, RA78K/II, and RA78K/III.
Fuzzy inference module	Program executing the fuzzy inference. Linked to the fuzzy knowledge data to perform fuzzy inference.
Fuzzy inference knowledge debugger	Support program for evaluation and adjustment of the fuzzy knowledge data on the hardware level by using an in-circuit emulator.

Note Under development

Remark The above programs support the MS-DOS and PC DOS operating systems.

5.4 List of Tools

5.4.1 List of development tools and evaluation tools

(1) List of 78K/0 series tools (1/2)

Target devices	Package	In-circuit emulator	Emulation probe	Conversion socket ^{Note 1}	Evaluation board
μPD78001B,	64SDIP	IE-78000-R	EP-78240CW-R	—	—
78002B,	64SDIP with window ^{Note 2}	+			
78001BY,					
78002BY,	64QFP (14 × 14 mm)	IE-78014-R-EM	EP-78240GC-R	EV-9200GC-64	
78011B,					
78012B,					
78013,					
78014,					
78P014,					
78011BY,					
78012BY,					
78013Y,					
78014Y,					
78P014Y					
μPD78023,	64SDIP	IE-78000-R	EP-78024CW-R	—	
78024,	64SDIP with window ^{Note 3}	+			
78P024*	64QFP (14 × 20 mm)	IE-78044-R-EM	EP-78024GF-R	EV-9200G-64	
μPD78042A,	80QFP (14 × 20 mm)		EP-78130GF-R	EV-9200G-80	
78043A,	80WQFN (14 × 20 mm) ^{Note 4}				
78044A,					
78045A,					
78P048A*					

Notes 1. Socket to connect the emulation probe for the QFP to the target system. It is mounted on the board of the target system.

2. Only for the μPD78P014 and 78P014Y.

3. Only for the μPD78P024.

4. Only for the μPD78P048A.

Remark The number in the parentheses following the QFP, WQFN indicates the size of package.

*: Under development

(1) List of 78K/0 series tools (2/2)

Target devices	Package	In-circuit emulator	Emulation probe	Conversion socket/ conversion adapter ^{Note 1}	Evaluation board
μ PD78052, 78053, 78054, 78P054, 78055, 78056, 78058, 78P058, 78052Y, 78053Y, 78054Y, 78P054Y,* 78055Y, 78056Y, 78058Y,* 78P058Y*	^{Note 2} 80TQFP (12 x 12 mm)	IE-78000-R +	EP-78054GK-R	EV-9500GK-80	—
	80QFP (14 x 14 mm)		EP-78230GC-R	EV-9200GC-80	
	^{Note 3} 80WQFN (14 x 14 mm)	IE-78064-R-EM			
μ PD78062, 78063, 78064, 78P064	100QFP (14 x 14 mm)		EP-78064GC-R	EV-9500GC-100	
	100QFP (14 x 20 mm)		EP-78064GF-R	EV-9200GF-100	
	^{Note 4} 100WQFN (14 x 20 mm)				
μ PD78074,* 78075,* 78076, 78078,* 78P078*		IE-78000-R + IE-78078-R-EM			
μ PD78081,* 78082,* 78P083*	42SDIP		EP-78083CU-R*	—	
	^{Note 5} 42SDIP with window				
	44QFP (10 x 10 mm)		EP-78083GB-R*	EV-9200G-44	
μ PD78094, 78095, 78096, 78098A,* 78P098A*	80QFP (14 x 14 mm)	IE-78000-R +	EP-78230GC-R	EV-9200GC-80	
	^{Note 6} 80WQFN (14 x 14 mm)				
		IE-78098-R-EM			

Notes 1. Socket or adapter to connect the emulation probe for the QFP to the target system. It is mounted on the board of the target system.

2. Except the μ PD78P058 and μ PD78054Y subseries. The μ PD78055, 78056, and 78058 are under planning.

3. Only for the μ PD78P054, 78P054Y, 78P058, and 78P058Y. The μ PD78P054Y, 78P058, and 78P058Y are under development.

4. Only for the μ PD78P064 and 78P078. Under development.

5. Only for the μ PD78P098.

Remark The number in the parentheses following the QFP indicates the size of package.

*: Under development

(2) List of 78K/I series tools

Target devices	Package	In-circuit emulator	Emulation probe	Conversion socket ^{Note}	Evaluation board
μPD78134, 78134A, 78136, 78138, 78P138	80QFP (14 × 20 mm) 80WQFN (14 × 20 mm)	IE-78130-R	EP-78130GF-R	EV-9200G-80	—
μPD78146, 78148, 78P148	100QFP (14 × 20 mm) 100WQFN (14 × 20 mm)	IE-78140-R	EP-78140GF-R	EV-9200GF-100	—

Note Socket to connect the emulation probe for the QFP to the target system. It is mounted on the board of the target system.

Remark The number in the parentheses following the QFP or WQFN indicates the size of package.

(3) List of 78K/II series tools

Target devices	Package	In-circuit emulator	Emulation probe	Conversion socket ^{Note 1}	Evaluation board		
μ PD78212, 78213, 78214, 78P214	64SDIP 64SDIP with window ^{Note 2} 64QUIP ^{Note 3} 64QFP (14 × 14 mm) 68QFJ ^{Note 3} 74QFP (20 × 20 mm)	IE-78240-R-A	EP-78240CW-R EP-78240GQ-R EP-78240GC-R EP-78240LP-R EP-78240GJ-R	— EV-9200GC-64 — EV-9200G-74	EB-78240-98 EB-78240-PC		
μ PD78217A, 78218A, 78P218A	64SDIP 64SDIP with window ^{Note 4} 64QFP (14 × 14 mm)		IE-78240-R-A	EP-78240CW-R EP-78240GC-R	— EV-9200GC-64	EB-78240-98 EB-78240-PC	
μ PD78220, 78224, 78P224	84QFJ 94QFP (20 × 20 mm)		IE-78230-R-A	EP-78230LQ-R EP-78230GJ-R	— EV-9200G-94	EB-78220-98 EB-78220-PC	
μ PD78233, 78234, 78237, 78238, 78P238	80QFP (14 × 14 mm) 84QFJ 94QFP (20 × 20 mm) 94WQFN (20 × 20 mm) ^{Note 5}		IE-78230-R-A	EP-78230GC-R EP78230LQ-R EP-78230GJ-R	EV-9200GC-80 — EV-9200G-94	EB-78230-98 EB-78230-PC	
μ PD78243, 78244	64SDIP 64QFP (14 × 14 mm)			IE-78240-R-A	EP-78240CW-R EP-78240GC-R	— EV-9200GC-64	EB-78240-98 EB-78240-PC

Notes 1. Socket to connect the emulation probe for the QFP to the target system. It is mounted on the board of the target system.

2. Only for the μ PD78P214.

3. Except the μ PD78212.

4. Only for the μ PD78P218A.

5. Only for the μ PD78P238.

Remark The number in the parentheses following the QFP or WQFN indicates the size of package.

(4) List of 78K/III series tools (1/2)

Target devices	Package	In-circuit emulator	Emulation probe	Conversion socket ^{Note 1}	Evaluation board
μ PD78310A, 78312A, 78P312A	64SDIP	IE-78310A-R ^{Note 3}	EP-78310CW	—	—
	64SDIP with window ^{Note 2}		EP-78310GQ	—	
	64QUIP				
	64QUIP with window ^{Note 2}		EP-78310GF	EV-9200G-64	
	64QFP (14 × 20 mm)				
	68QFJ		EP-78310L	—	
μ PD78320, 78322, 78P322, 78323, 78324, 78P324	68QFJ	IE-78327-R	EP-78320L-R	—	EB-78320-98
	68WQFN ^{Note 4}		EP-78320GJ-R	EV-9200G-74	EB-78320-PC
	74QFP (20 × 20 mm)				EP-78320GF-R
	74WQFN (20 × 20 mm) ^{Note 4}				
	80QFP (14 × 20 mm) ^{Note 5}				
	80WQFN (14 × 20 mm) ^{Note 6}				
	μ PD78327, 78328, 78P328		64SDIP	IE-78330-R	EP-78327CW-R
64SDIP with window ^{Note 7}		EP-78327GF-R	EV-9200G-64		EB-78327-PC
64QFP (14 × 20 mm)					
μ PD78330, 78334, 78P334	84QFJ	IE-78330-R	EP-78330LQ-R	—	EB-78330-98
	84WQFN ^{Note 8}		EP-78330GJ-R	EV-9200G-94	EB-78330-PC
	94QFP (20 × 20 mm)				
	94WQFN (20 × 20 mm) ^{Note 8}				

Notes 1. Socket to connect the emulation probe for the QFP to the target system. It is mounted on the board of the target system.

2. Only for the μ PD78P312A.

3. A user who has the IE-78310-R can use it as the IE-78310A-R by purchasing only the Evachip and monitor program kit (μ S008IM78312A).

4. Only for the μ PD78P322 and 78P324.

5. Only for the μ PD78320, 78322, and 78P322.

6. Only for the μ PD78P322.

7. Only for the μ PD78P328.

8. Only for the μ PD78P334.

Remark The number in the parentheses following the QFP or WQFN indicates the size of package.

(4) List of 78K/III series tools (2/2)

Target devices	Package	In-circuit emulator	Emulation probe	Conversion socket/ conversion adapter: ^{Note 1}	Evaluation board
μ PD78350, 78350A, 78352A, 78P352	64QFP (14 x 14 mm) 64WQFN (14 x 14 mm) ^{Note 2}	IE-78350-R + IE-78350-R-EM1	EP-78240GC-R	EV-9200GC-64	EB-78350-98 EB-78350-PC
μ PD78355,* 78356,* 78P356*	100QFP (14 x 14 mm) 120QFP (28 x 28 mm) 120WQFN (28 x 28 mm) ^{Note 3}	IE-78350-R + IE-78355-R-EM1	EP-78355GC-R EP-78355GD-R	EV-9500GC-100 ^{Note 4} EV-9501GC-100 ^{Note 4} EV-9500GC-100 ^{Note 4} EV-9200GD-120	—
μ PD78365,* 78366,* 78P368*	80QFP (14 x 20 mm) 80WQFN (14 x 20 mm) ^{Note 5}	IE-78350-R + IE-78365-R-EM1	EP-78365GF-R	EV-9200G-80	—
μ PD78370,* 78372,* 78P372*	80QFP (14 x 20 mm) 80WQFN (14 x 20 mm) ^{Note 6}	IE-78350-R + IE-78370-R-EM1	EP-78365GF-R	EV-9200G-80	—

Notes 1. A socket or adapter to connect the emulation probe for the QFP to the target system. It is mounted on the board of the target system.

2. Only for the μ PD78P352. Under development.

3. Only for the μ PD78P356.

4. The EV-9501GC-100 is an adapter used when it is connected to the EP-78355GD-R (120 pins). It converts 120 pins to 100 pins. The EV-9500GC-100 is a conversion adapter for connection to the EV-9501GC-100, and is mounted on the board of the target system.

5. Only for the μ PD78P368.

6. Only for the μ PD78P372.

Remarks 1. The number in the parentheses following the QFP or WQFN indicates the size of package.

2. The I/O emulation board (IE-78xxx-R-EM1) is sold separately from the IE proper.

*: Under development

(5) List of 78K/IV series tools

Target devices	Package	In-circuit emulator	Emulation probe	Conversion socket ^{Note 1}	Evaluation board
μPD784020,*	80QFP (14 × 14 mm)	IE-784000-R*	EP-78230GC-R	EV-9200GC-80	—
784021,*		+			
784025,*		IE-784000-R-EM*			
784026,*	80WQFN (14 × 14 mm)	+			
78P4026*		IE-784026-R-EM1*			

Notes 1. Socket to connect the emulation probe for the QFP to the target system. It is mounted on the board of the target system.

2. Only for the μPD78P4026.

Remarks 1. The number in the parentheses following the QFP or WQFN indicates the size of package.

2. An interface board sold separately is necessary for each host machine.

Host machine	Interface board
PC-9800 series (except for the note type)	IE-70000-98-IF-B*
PC-9800 series (note type)	IE-70000-98N-IF*
IBM PC/AT	IE-70000-PC-IF-B*
EWS	IE-78000-R-SV3*

*: Under development

(1) List of VDK11 series software tools (7/15)

Target device	Hardware assembly	C compiler	C library source	Screen debugger	Device file simulator	OS	Run-time OS
V707001B	RAT000	CC78K0	CC78K0-L	SD78K0	DF18003	VX78K0*	---
78002B							
V7078001BY							
78002BY							
V7078011B					DF1801A		
78012B							VX78013
78013							
78014							
78015							
V7078011BY							---
78012BY							VX78013
78013Y							
78014Y							
78015Y							
V7078023					DF1802A		---
7802A							
7802A*							
V7078023A					DF1802A		
7802A							VX78013
7802A							
7802A							
7802A*							

*: Under development

5.4.2 List of software tools

(MEMO)

(1) List of 78K/0 series software tools (1/2)

Target device	Relocatable assembler	C compiler	C Library source	Screen debugger	Device file	System simulator	OS	Real-time OS
μPD78001B, 78002B	RA78K/0	CC78K/0	CC78K/0-L	SD78K/0	DF78002	SM78K/0*	MX78K/0*	—
μPD78001BY, 78002BY					DF78014			RX78013
μPD78011B, 78012B, 78013, 78014, 78P014								
μPD78011BY, 78012BY, 78013Y, 78014Y, 78P014Y								—
RX78013								
								μPD78023, 78024, 78P024*
μPD78042A, 78043A, 78044A, 78045A, 78P048A*					DF78044			RX78013

*: Under development

(1) List of 78K/0 series software tools (2/2)

Target device	Relocatable assembler	C compiler	C Library source	Screen debugger	Device file	System simulator	OS	Real-time OS
μPD78052, 78053, 78054, 78P054, 78055, 78056, 78058, 78P058	RA78K/0	CC78K/0	CC78K/0-L	SD78K/0	DF78054	SM78K/0*	MX78K/0*	—
								RX78013
μPD78052Y, 78053Y, 78054Y, 78P054Y,* 78055Y, 78056Y, 78058Y,* 78P058Y*								—
								RX78013
μPD78062, 78063, 78064, 78P064					DF78064			—
								RX78013
μPD78074,* 78075,* 78076, 78078,* 78P078*					DF78078*			
μPD78081,* 78082,* 78P083*					DF78083*			—
μPD78094, 78095, 78096, 78098A,* 78P098A*					DF78098			RX78013

*: Under development

Fuzzy knowledge data creation tool	Translator	Fuzzy inference module	Fuzzy inference debugger
FE9000/ FE9200	FT9080/ FT9085	FI78K0	FD78K0

(2) List of 78K/I series software tools

Target device	IE control program	Relocatable assembler	C compiler	C library source	Screen debugger	Device file
μPD78134, 78134A, 78136, 78138, 78P138	IE78130	RA78K/I				
μPD78146, 78148, 78P148	IE78140					

(3) List of 78K/II series software tools

Target Device	Relocatable assembler	C compiler	C library source	Screen debugger	Device file	Real-time OS
μPD78212, 78213, 78214, 78P214	RA78K/II	CC78K/II	CC78K/II-L	SD78K/II (IE-78230-R-A) (IE-78240-R-A)	DF78210	—
μPD78217A, 78218A, 78P218A						RX78217
μPD78220, 78224, 78P224					DF78220	—
μPD78233, 78234, 78237, 78238, 78P238					DF78230	RX78217
μPD78234, 78244					DF78240	—

(4) List of 78K/III series software tools

Target device	IE control program	Relocatable assembler	C compiler	C library source	Real-time OS
μPD78310A, 78312A, 78P312A	IE78310	RA78K/III (with structured assembler)	CC78K/III	CC78K/III-L	—
μPD78320, 78322, 78P322, 78323, 78324, 78P324	IE78327				RX78320
μPD78327, 78328, 78P328					
μPD78330, 78334, 78P334	IE78330				Under consideration
μPD78350, 78350A, 78352A, 78P352	IE78350				
μPD78355,* 78356,* 78P356*	IE78355				
μPD78365,* 78366,* 78P368*	IE78365				
μPD78370,* 78372,* 78P372*	IE78370				

*: Under development

Fuzzy knowledge data creation tool	Translator	Fuzzy inference module	Fuzzy inference debugger
FE9000/ FE9200	FT78K3	FI78K3	FD78K3

(5) List of 78K/IV series software tools

Target device	Relocatable assembler	C compiler	C library source	Integrated debugger	Device file	Real-time OS
μ PD784020,* 784021,* 784025,* 784026,* 78P4026*	RA78K/IV*	CC78K/IV*	CC78K/IV-L*	ID78K/IV*	DF784026*	RX78K/IV* (Tentative)

*: Under development

- Remarks 1.** Software products are all available for either PC-9800 series (MS-DOS based) or IBM PC/AT (PC DOS based) host machines.
- 2.** The ordering code for software products depends on the operating system and supply medium. Refer to individual device documentation for details.

5.5 Development Tool System Upgrading

Table 5-2. Development Tool System Upgrades (1/6)

System upgrade Target device Current tool	IE-78000-R ^{Note 2}				
	μPD78002 subseries	μPD78024 subseries	μPD78054 subseries	μPD78078 subseries	μPD78098 subseries
	μPD78002Y subseries	μPD78044A subseries	μPD78054Y subseries	μPD78083 subseries	
	μPD78014 subseries		μPD78064 subseries		
	μPD78014Y subseries				
IE-75000-R ^{Note 1}	IE-78014-R-EM	IE-78044-R-EM	IE-78064-R-EM	IE-78078-R-EM	IE-78098-R-EM
IE-75001-R	IE-78000-R-BK	IE-78000-R-BK	IE-78000-R-BK	IE-78000-R-BK	IE-78000-R-BK
IE-78000-R	IE-78014-R-EM	IE-78044-R-EM	IE-78064-R-EM	IE-78078-R-EM	IE-78098-R-EM
IE-78112-R ^{Note 1}	Cannot be upgraded.				
IE-78130-R	IE-78014-R-EM	IE-78044-R-EM	IE-78064-R-EM	IE-78078-R-EM	IE-78098-R-EM
IE-78140-R	IE-78000-R-BK	IE-78000-R-BK	IE-78000-R-BK	IE-78000-R-BK	IE-78000-R-BK
IE-78210-R ^{Note 1}	Cannot be upgraded.				
IE-78220-R ^{Note 1}					
IE-78230-R ^{Note 1}					
IE-78230-R-A	IE-78014-R-EM	IE-78044-R-EM	IE-78064-R-EM	IE-78078-R-EM	IE-78098-R-EM
IE-78240-R ^{Note 1}	IE-78000-R-BK	IE-78000-R-BK	IE-78000-R-BK	IE-78000-R-BK	IE-78000-R-BK
IE-78240-R-A					
IE-78310-R ^{Note 1}	Cannot be upgraded.				
IE-78310A-R					
IE-78320-R ^{Note 1}					
IE-78327-R	IE-78014-R-EM	IE-78044-R-EM	IE-78064-R-EM	IE-78078-R-EM	IE-78098-R-EM
IE-78330-R	IE-78000-R-BK	IE-78000-R-BK	IE-78000-R-BK	IE-78000-R-BK	IE-78000-R-BK
IE-78350-R					
IE-784000-R*	Cannot be upgraded.				

*: Under development

Notes 1. Maintenance product

2. This is the main body of an IE set. This should be used together with an emulation board.

Remarks 1. Where two product names are given in a column, the upper and lower product names are those of the emulation board and the break board required for system upgrade, respectively.

2. Refer to the table on the next page for the devices to be developed and simulated for the μPD780xx subseries.

3. The in-circuit emulators (IE-78130-R and IE-78140-R) for the 78K/I series cannot be upgraded from the other in-circuit emulator. However, upgrading vice versa is possible.

4. For details of target devices (μPD780xx subseries), refer to Table 5-2. Development Tool System Upgrades (2/6).

Table 5-2. Development Tool System Upgrades (2/6)

[Target device of the μ PD780xx subseries]

Subseries name	Target device
μ PD78002	μ PD78001B, 78002B, 78P014
μ PD78002Y	μ PD78001BY, 78002BY, 78P014Y
μ PD78014	μ PD78011B, 78012B, 78013, 78014, 78P014
μ PD78014Y	μ PD78011BY, 78012BY, 78013Y, 78014Y, 78P014Y
μ PD78024	μ PD78023, 78024, 78P024 ^{Note}
μ PD78044A	μ PD78042A, 78043A, 78044A, 78045A, 78P048A ^{Note}
μ PD78054	μ PD78052, 78053, 78054, 78P054, 78055, 78056, 78058, 78P058
μ PD78054Y	μ PD78052Y, 78053Y, 78054Y, 78P054Y ^{Note} , 78055Y, 78056Y, 78058Y ^{Note} , 78P058Y ^{Note}
μ PD78064	μ PD78062, 78063, 78064, 78P064
μ PD78078	μ PD78074 ^{Note} , 78075 ^{Note} , 78076, 78078 ^{Note} , 78P078 ^{Note}
μ PD78083	μ PD78081 ^{Note} , 78082 ^{Note} , 78P083 ^{Note}
μ PD78098	μ PD78094, 78095, 78096, 78098A, 78P098 ^{Note}

Note Under development

Table 5-2. Development Tool System Upgrades (3/6)

System upgrade Target device Current tool	IE-78230-R-A		IE-78240-R-A		
	μPD78220, 78224, 78P224	μPD78233, 78234, 78237, 78238, 78P238	μPD78212, 78213, 78214, 78P214	μPD78217A, 78218A, 78P218A	μPD78243, 78244
IE-75000-R ^{Note 1}	IE-78230-R-EM IE-78200-R-BK		IE-78240-R-EM IE-78200-R-BK		
IE-75001-R					
IE-78000-R					
IE-78112-R ^{Note 1}	IE-78230-R-EM ^{Note 2} IE-78200-R-BK	IE-78230-R-EM IE-78200-R-BK	IE-78240-R-EM ^{Note 3} IE-78200-R-BK	IE-78240-R-EM IE-78200-R-BK	
IE-78130-R	IE-78230-R-EM IE-78200-R-BK		IE-78240-R-EM IE-78200-R-BK		
IE-78140-R	IE-78230-R-EM		IE-78240-R-EM		
IE-78210-R ^{Note 1}	IE-78230-R-EM ^{Note 2} IE-78200-R-BK	IE-78230-R-EM IE-78200-R-BK	IE-78200-R-BK	IE-78240-R-EM IE-78200-R-BK	
IE-78220-R ^{Note 1}	IE-78200-R-BK		IE-78240-R-EM ^{Note 3} IE-78200-R-BK		
IE-78230-R ^{Note 1}	IE-78200-R-BK		IE-78240-R-EM IE-78200-R-BK		
IE-78230-R-A	Can be used without modification.		IE-78240-R-EM		
IE-78240-R ^{Note 1}	IE-78230-R-EM IE-78200-R-BK		IE-78200-R-BK		
IE-78240-R-A	IE-78230-R-EM		Can be used without modification.		
IE-78310-R ^{Note 1}	IE-78230-R-EM ^{Note 2} IE-78200-R-BK	IE-78230-R-EM IE-78200-R-BK	IE-78240-R-EM ^{Note 3} IE-78200-R-BK	IE-78240-R-EM IE-78200-R-BK	
IE-78310A-R					
IE-78320-R ^{Note 1}	IE-78230-R-EM IE-78200-R-BK		IE-78240-R-EM IE-78200-R-BK		
IE-78327-R					
IE-78330-R					
IE-78350-R					
IE-784000-R*	Cannot be upgraded.				

*: Under development

Notes 1. Maintenance product.

2. The IE-78220-R-EM (maintenance product) can be used instead of the IE-78230-R-EM.

3. The IE-78210-R-EM (maintenance product) can be used instead of the IE-78240-R-EM.

Remark Where two product names are given in a column, the upper and lower product names are those of the emulation board and the break board required for system upgrade, respectively.

Table 5-2. Development Tool System Upgrades (4/6)

System upgrade Target device Current tool	IE-78310A-R	IE-78320-R ^{Note 1}	IE-78327-R	IE-78330-R
	μPD78310A, 78312A, 78P312A	μPD78320, 78322, 78323, 78324, 78P322, 78P324	μPD78320, 78322, 78323, 78324, 78P322, 78P324 μPD78327, 78328, 78P328	μPD78330, 78334, 78P334
IE-75000-R ^{Note 1}	Cannot be upgraded.	Cannot be upgraded.		
IE-75001-R				
IE-78000-R		Note 3	IE-78330-R-BK IE-78327-R-EM	IE-78330-R-BK IE-78330-R-EM
IE-78112-R ^{Note 1}		Cannot be upgraded.		
IE-78130-R		Note 3	IE-78330-R-BK IE-78327-R-EM	IE-78330-R-BK IE-78330-R-EM
IE-78140-R				
IE-78210-R ^{Note 1}		Cannot be upgraded.		
IE-78220-R ^{Note 1}				
IE-78230-R ^{Note 1}		Note 3	IE-78330-R-BK IE-78327-R-EM	IE-78330-R-BK IE-78330-R-EM
IE-78230-R-A				
IE-78240-R ^{Note 1}				
IE-78240-R-A				
IE-78310-R ^{Note 1}		Cannot be upgraded.		
IE-78310A-R		Can be used without modification.		
IE-78320-R ^{Note 1}	Cannot be upgraded.	Can be used without modification.	IE-78330-R-BK IE-78327-R-EM	IE-78330-R-BK IE-78330-R-EM
IE-78327-R		Can be used without modification.		IE-78330-R-EM
IE-78330-R		Note 3	IE-78327-R-EM	Can be used without modification.
IE-78350-R			IE-78330-R-BK IE-78327-R-EM	IE-78330-R-BK IE-78330-R-EM
IE-784000-R*			Cannot be upgraded.	

*: Under development

Notes 1. Maintenance product.

2. A system upgrade can be performed with Evachip and a monitor program kit (μS0081M78312A).
3. A system upgrade is recommended to the IE-78327-R which includes IE-78320-R functions.

Remark Where two product names are given in a column, the upper and lower product names are those of the break board and the emulation board required for system upgrade, respectively.

Table 5-2. Development Tool System Upgrades (5/6)

System upgrade Target device Current tool	IE-78350-R ^{Note 2}			
	μPD78350, 78350A, 78352A, 78P352	μPD78355,* 78356,* 78P356*	μPD78365,* 78366,* 78P368*	μPD78370,* 78372,* 78P372*
IE-75000-R ^{Note 1}	Cannot be upgraded.			
IE-75001-R				
IE-78000-R	IE-78350-R-BK IE-78350-R-EM IE-78350-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78355-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78365-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78370-R-EM1
IE-78112-R ^{Note 1}	Cannot be upgraded.			
IE-78130-R	IE-78350-R-BK IE-78350-R-EM IE-78350-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78355-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78365-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78370-R-EM1
IE-78140-R	IE-78350-R-BK IE-78350-R-EM IE-78350-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78355-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78365-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78370-R-EM1
IE-78210-R ^{Note 1}	Cannot be upgraded.			
IE-78220-R ^{Note 1}				
IE-78230-R ^{Note 1}	IE-78350-R-BK IE-78350-R-EM IE-78350-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78355-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78365-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78370-R-EM1
IE-78230-R-A	IE-78350-R-BK IE-78350-R-EM IE-78350-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78355-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78365-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78370-R-EM1
IE-78240-R ^{Note 1}	IE-78350-R-BK IE-78350-R-EM IE-78350-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78355-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78365-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78370-R-EM1
IE-78240-R-A	IE-78350-R-BK IE-78350-R-EM IE-78350-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78355-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78365-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78370-R-EM1
IE-78310-R ^{Note 1}	Cannot be upgraded.			
IE-78310A-R				
IE-78320-R ^{Note 1}	IE-78350-R-BK IE-78350-R-EM IE-78350-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78355-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78365-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78370-R-EM1
IE-78327-R	IE-78350-R-BK IE-78350-R-EM IE-78350-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78355-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78365-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78370-R-EM1
IE-78330-R	IE-78350-R-BK IE-78350-R-EM IE-78350-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78355-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78365-R-EM1	IE-78350-R-BK IE-78350-R-EM IE-78370-R-EM1
IE-78350-R	— — IE-78350-R-EM1	— — IE-78355-R-EM1	— — IE-78365-R-EM1	— — IE-78370-R-EM1
IE-784000-R*	Cannot be upgraded.			

*: Under development

Notes 1. Maintenance product.

2. This is the main body of an IE set. This should be used together with an I/O emulation board.

Remarks 1. Where three product names are given in a column, the upper, middle, and lower product names are those of the break board, emulation board, and I/O emulation board required for system upgrade, respectively.

2. Where one product name is given in a column with "—" above it, a system upgrade only requires the addition of an I/O emulation board (sold separately).

Table 5-2. Development Tool System Upgrades (6/6)

System upgrade Target device Current tool	IE-784000-R* Note 2	
	μPD784020, 784021,* 784025,* 784026,* 78P4026*	
IE-75000-R Note 1	IE-784000-R-EM*	} Note 3
IE-75001-R	IE-784026-R-EM1*	
IE-78000-R	IE-784000-R-BK*	
IE-78112-R Note 1	Cannot be upgraded.	
IE-78130-R	IE-784000-R-EM*	} Note 3
IE-78140-R	IE-784026-R-EM1*	
	IE-784000-R-BK*	
IE-78210-R Note 1	Cannot be upgraded.	
IE-78220-R Note 1		
IE-78230-R Note 1	IE-784000-R-EM*	} Note 3
IE-78230-R-A	IE-784026-R-EM1*	
IE-78240-R Note 1	IE-784000-R-BK*	
IE-78240-R-A		
IE-78310-R Note 1	Cannot be upgraded.	
IE-78310A-R		
IE-78320-R Note 1	IE-784000-R-EM*	} Note 3
IE-78327-R	IE-784026-R-EM1*	
IE-78330-R	IE-784000-R-BK*	
IE-78350-R		
IE-784000-R*	IE-784000-R-EM*	
	IE-784026-R-EM1*	

*: Under development

Notes 1. Maintenance product

2. This is the main body of an IE set. This should be used together with an emulation board and peripheral emulation board.

3. Contact to NEC sales person.

Remark Where three product names are given in a column, the upper, middle, and lower product names are those of the emulation board, peripheral emulation board, and break board required for system upgrade, respectively.

Where two product names are given in a column, the upper and lower product names are those of the emulation board and the peripheral emulation board, respectively.

5.6 List of PROM Programmer Adapters

Table 5-3. List of Programmer Adapters (1/3)

On-chip PROM product	Package	PROM programmer	Programmer adapter
μ PD78P014	64SDIP, 64SDIP with window	PG-1500	PA-78P014CW
μ PD78P014Y	64QFP (14 × 14 mm)		PA-78P014GC
μ PD78P024*	64SDIP, 64SDIP with window	PG-1500	PA-78P024CW
	64QFP (14 × 20 mm)		PA-78P024GF
	64WQFN (14 × 20 mm)		PA-78P024KL-R
μ PD78P044	80QFP (14 × 20 mm)		PA-78P044GF
	80WQFN (14 × 20 mm)		PA-78P044KL-S
μ PD78P048A*	80QFP (14 × 20 mm)		PA-78P048GF
	80WQFN (14 × 20 mm)		PA-78P048KL-S
μ PD78P054, 78P054Y*	80TQFP (12 × 12 mm) ^{Note}		PA-78P054GK
μ PD78P058, 78P058Y*	80QFP (14 × 14 mm)		PA-78P054GC
μ PD78P098A*	80WQFN (14 × 14 mm)*		PA-78P054KK-T
μ PD78P064	100QFP (14 × 14 mm)	PG-1500	PA-78P064GC
	100QFP (14 × 20 mm)		PA-78P064GF
	100WQFN (14 × 20 mm)*		PA-78P064KL-T
μ PD78P078*	100QFP (14 × 14 mm)		PA-78P078GC
	100QFP (14 × 20 mm)		PA-78P078GF
	100WQFN (14 × 20 mm)		PA-78P078KL-T
μ PD78P083*	42SDIP, 42SDIP with window		PA-78P083CU*
	44QFP (10 × 10 mm)		PA-78P083GB*
μ PD78P138	80QFP (14 × 20 mm)		PA-78P138GF
	80WQFN (14 × 20 mm)		PA-78P138K
μ PD78P148	100QFP (14 × 20 mm)		PA-78P148GF
	100WQFN (14 × 20 mm)		PA-78P148K
μ PD78P214	64SDIP, 64SDIP with window	PG-1500	PA-78P214CW
	64QUIP		PA-78P214GQ
	64QFP (14 × 14 mm)		PA-78P214GC
	68QFJ		PA-78P214L
	74QFP (20 × 20 mm)		PA-78P214GJ
μ PD78P218A	64SDIP, 64SDIP with window		PA-78P214CW
	64QFP (14 × 14 mm)		PA-78P214GC

*: Under development

Note μ PD78P054 only

Table 5-3. List of Programmer Adapters (2/3)

On-chip PROM product	Package	PROM programmer	Programmer adapter
μ PD78P224	84QFJ	PG-1500	PA-78P224L
	94QFP (20 × 20 mm)		PA-78P224GJ
μ PD78P238	80QFP (14 × 14 mm)		PA-78P238GC
	84QFJ		PA-78P238LQ
	94QFP (20 × 20 mm)		PA-78P238GJ
	94WQFN (20 × 20 mm)		PA-78P238KF
μ PD78P312A	64SDIP, 64SDIP with window		PA-78P312CW
	64QUIP, 64QUIP with window		PA-78P312GQ
	64QFP (14 × 20 mm)		PA-78P312GF
	68QFJ		PA-78P312L
μ PD78P322	68QFJ		PA-78P322L
	68WQFN		PA-78P322KC
	74QFP (20 × 20 mm)		PA-78P322GJ
	74WQFN (20 × 20 mm)		PA-78P322KD
	80QFP (14 × 20 mm)		PA-78P322GF
	80WQFN (14 × 20 mm)		PA-78P322K
μ PD78P324	68QFJ		PA-78P324LP
	68WQFN		PA-78P324KC
	74QFP (20 × 20 mm)		PA-78P324GJ
	74WQFN (20 × 20 mm)		PA-78P324KD
μ PD78P328	64SDIP, 64SDIP with window		PA-78P328CW
	64QFP (14 × 20 mm)		PA-78P328GF
μ PD78P334	84QFJ		PA-78P334LQ
	84WQFN		PA-78P334KW
	94QFP (20 × 20 mm)		PA-78P334GJ
	94WQFN (20 × 20 mm)		PA-78P334KM
μ PD78P352	64QFP (14 × 14 mm)		PA-78P352G*
	64WQFN (14 × 14 mm)*		PA-78P352KK*
μ PD78P356*	100QFP (14 × 14 mm)		PA-78P356GC*
	120QFP (28 × 28 mm)		PA-78P356GD*
	120WQFN (28 × 28 mm)		PA-78P356KP*

*: Under development

Table 5-3. List of Programmer Adapters (3/3)

On-chip PROM product	Package	PROM programmer	Programmer adapter
μ PD78P368*	80QFP (14 × 20 mm)	PG-1500	PA-78P368GF*
	80WQFN (14 × 20 mm)		PA-78P368KL*
μ PD78P372*	80QFP (14 × 20 mm)		PA-78P372GF
	80WQFN (14 × 20 mm)		PA-78P372KL
μ PD78P4026*	80QFP (14 × 14 mm)		PA-78P4026GC*
	80WQFN (14 × 14 mm)		PA-78P4026KK

*: Under development

6. THIRD-PARTY TOOL SUPPORT LIST

6.1 Development Tools by Third Parties

Table 6-1. 78K/0 Series Third-Party Tool Support List

Manufacturer	Contact	Support tool	78K/0 series								
			7800 x	7801 x	7802 x	7804 x	7805 x	7806 x	7807 x	7808 x	7809 x
Advanced Data Controls Corp.	Nihon Seimei Ohtsuka Bldg. 1-13-4 Kita-Ohtsuka, Toshima-ku, Tokyo 170 TEL 03-3576-5351	Compiler, assembler, simulator	○	○		○	○	○			
			○	○		○	○	○			
			○	○		○	○	○			
Gaio Technology Corp.	Iseryu Bldg., 3-8-2 Ningyo-cho, Nihonbashi, Chuoh-ku, Tokyo 103 TEL 03-3662-3041	Compiler, assembler, simulator	—	—	—	—	—	—			—
			○	○		○	○	○			
			○	○		○	○	○			
Lifeboat Corp.	3-6 Nishiki-cho, Kanda, Chiyoda-ku, Tokyo 101 TEL 03-3293-4714	Compiler, assembler, simulator	○	○		△	△	△			
			○	○		△	△	△			
			○	○		△	△	△			
Yokogawa Digital Computer Corp.	Advice div. Marketing dept. 1-19-3 Naka-machi, Musashino-shi, Tokyo 180 TEL 0422-56-9101	Emulator	○	○			○	○			
Naitoh Densai Machida MSGF Co., Ltd.	Marketing div. 1705-2 Kanamori, Machida-shi, Tokyo 194 TEL 0427-96-8611		○	○			○	○			
		RAM monitor	○	○	○	○	○	○	○	○	○
Ryosan Co., Ltd.	Application engineering dept. Sales support div. 2-18-22 Soto-kanda, Chiyoda-ku, Tokyo 101 TEL 03-5294-1254	Real-time RAM tracer	○	○		○	○	○			○
Pasotron Co.	5-29 Haruoka-dori, Chikusa-ku, Nagoya-shi 464 TEL 052-762-8590	Training kit	—	○	—	—	—	—			—
Service Center Corp.	681-3 Miyaoki-cho, Mihara-shi, Hiroshima 723 TEL 0848-63-0022		—	○	—	—	—	—			—
Data I/O Japan Corp.	Marketing div. Sumitomo Seimei Higashi-shimbashi Bldg. 2-1-7 Higashi-shimbashi, Minato-ku, Tokyo 105 TEL 03-3432-6991	PROM programmer	For details, see Table 6-4 78K/0 Series PROM Programmer Made by Third Party.								
Advantest Corp.	Customer Information Center (CIC) TEL 0120-04-1486 (Toll free)										
Ando Electric Co., Ltd.	4-19-7 Kamata, Ohta-ku, Tokyo 144 TEL 0120-40-0211 (Toll free)										

Remarks 1. Contact to each manufacturer for the host machine support.

2. The symbols mean the following:

○ : released

△ : possible if the defined file is modified

— : none

blank: undefined

Table 6-2. 78K/II Series Third-Party Tool Support List

Manufacturer	Contact	Support tool	78K/II series				
			78214	78218A	78224	78234	78244
Advanced Data Controls Corp.	Nihon Seimei Ohtuska Bldg. 1-13-4 Kita-Ohtsuka, Toshima-ku, Tokyo 170 TEL 03-3576-5351	Compiler, assembler, simulator	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○
Gaio Technology Corp.	Iseryu Bldg., 3-8-2 Ningyo-cho, Nihonbashi, Chuoh-ku, Tokyo 103 TEL 03-3662-3041	Compiler, assembler, simulator	— ○ ○	— ○ ○	— ○ ○	— ○ ○	— ○ ○
Lifeboat Corp.	3-6 Nishiki-cho, Kanda, Chiyoda-ku, Tokyo 101 TEL 03-3293-4714	Compiler, assembler, simulator	○ ○ —	○ ○ —	○ ○ —	○ ○ —	○ ○ —
Sophia Systems Co., Ltd.	Sales promotion dept., Sales div. Shinjuku NS Bldg. 8F, 2-4-1 Nishi-Shinjuku, Shinjuku-ku, Tokyo 163 TEL 03-3348-7000	Emulator	○	○	○	○	○
Yokogawa Digital Computer Corp.	Advice div. Marketing dept. 1-19-3 Naka-machi, Musashino-shi, Tokyo 180 TEL 0422-56-9101	Emulator	○	○	○	○	○
Yokogawa Hewlett Packard Co.	Marketing group 1-3-2 Muro-ya, Nishi-ku, Kobe-shi, Hyogo 651-22 TEL 0120-08-1444 (Toll free)	Emulator	○	○	○	○	○
Naitoh Densei Machida MSGF Co., Ltd.	Marketing div. 1705-2 Kanamori, Machida-shi, Tokyo 194 TEL 0427-96-8611	RAM monitor	○	○	○	○	○
Data I/O Japan Corp.	Marketing div. Sumitomo Seimei Higashi-shimbashi Bldg. 2-1-7 Higashi-shimbashi, Minato-ku, Tokyo 105 TEL 03-3432-6991	PROM programmer	For details, see Table 6-5 78K/II Series PROM Programmer Made by Third Party.				
Advantest Corp.	Customer Information Center (CIC) TEL 0120-04-1486 (Toll free)						
Ando Electric Co., Ltd.	4-19-7 Kamata, Ohta-ku, Tokyo 144 TEL 0120-40-0211 (Toll free)						

Remarks 1. Contact to each manufacturer for the host machine support.

2. The symbols mean the following:

○: released

—: none

Table 6-3. 78K/III Series Third-Party Tool Support List

Manufacturer	Contact	Support tool	78K/III Series						
			7831 x	7832 x	7833 x	78352A	78356	7836 x	7837 x
Gaio Technology Corp.	Iseryu Bldg., 3-8-2 Ningyo-cho, Nihonbashi, Chuoh-ku, Tokyo 103 TEL 03-3662-3041	Compiler, assembler, simulator	— ○ ○	— ○ ○	— ○ ○	— ○ ○	— ○ ○	— ○ ○	— — —
Lifeboat Corp.	3-6 Nishiki-cho, Kanda, Chiyoda-ku, Tokyo 101 TEL 03-3293-4714	Compiler, assembler, simulator	○ ○ ○	○ ○ ○	○ ○ ○	— — —	— — —	— — —	— — —
Sophia Systems Co., Ltd.	Sales promotion dept., Sales div. Shinjuku NS Bldg. 8F, 2-4-1 Nishi-Shinjuku, Shinjuku-ku, Tokyo 163 TEL 03-3348-7000	Emulator	○	—	—	—	—	—	—
Yokogawa Digital Computer Corp.	Advice div. Marketing dept. 1-19-3 Naka-machi, Musashino-shi, Tokyo 180 TEL 0422-56-9101		○	—	—	—	○	○	○
Pasotron Co.	5-29 Haruoka-dori, Chikusa-ku, Nagoya-shi 464 TEL 052-762-8590	Training kit	—	○Note	—	—	—	—	—
Data I/O Japan Corp.	Marketing div. Sumitomo Seimei Higashi-shimbashi Bldg. 2-1-7 Higashi-shimbashi Minato-ku, Tokyo 105 TEL 03-3432-6991	PROM programmer	For details, see Table 6-6 78K/III Series PROM Programmer Made by Third Party.						
Advantest Corp.	Customer Information Center (CIC) TEL 0120-04-1486 (Toll free)								
Ando Electric Co., Ltd.	4-19-7 Kamata, Ohta-ku, Tokyo 144 TEL 0120-40-0211 (Toll free)								
AVAL DATA Corp.	Information system div. Shinyuri-21 Bldg., 1-2-2 Manpukuji, Asao-ku, Kawasaki-shi, Kanagawa 215 TEL 044-952-1311								

Note μ PD78320, 78322, 78P322 only

Remarks 1. Contact to each manufacturer for the host machine support.

2. The symbols mean the following:

○: released

—: none

Remarks: The symbols mean the following:
 ○: recognized △: Condition under way —: not recognized

3. Under development

made by the company must be used.

2. When data is written by a PROM programmer made by Data I/O Japan Corp., a programmer address must be used.

Notes 1: A code necessary when using a programmer address made by Data I/O Japan Corp.

On-chip PROM Address	Program type	Programmer code	PROM programmer		
			Program name	On-chip address	2900
On-chip PROM Address	Program type	Programmer code	Program name	On-chip address	2900
			Program name	On-chip address	2900
			Program name	On-chip address	2900
			Program name	On-chip address	2900
			Program name	On-chip address	2900
			Program name	On-chip address	2900
			Program name	On-chip address	2900
			Program name	On-chip address	2900
			Program name	On-chip address	2900
			Program name	On-chip address	2900
			Program name	On-chip address	2900
			Program name	On-chip address	2900

Table 8-4: 2900 Series PROM Programmer Made by Third Party

6.2 PROM Programmer Made by Third Party

[OM3M]

Table 6-4. 78K/0 Series PROM Programmer Made by Third Party

On-chip PROM product	Program- ming mode	Programmer adapter	F/P code ^{Note 1}	PROM programmer		
			Product name	UNISITE	2900	3900
			Socket adapter	PinSite (sold separately)	Unnecessary	
			Others	Base for PinSite PPI adapter (sold separately)	Base for 2900 PPI adapter (sold separately) For library 2900 for microcomputer (sold separately)	Base for 3900 PPI adapter (sold separately) For library 3900 for microcomputer (sold separately)
			Manufacturer	Data I/O Japan Corp.		
μPD78P014CW	μPD27C256A mode	PPI-0604 ^{Note 2}	245/386	○	○	○
		PA-78P014CW	None	—	—	—
μPD78P014GC		PPI-0510 ^{Note 2}	245/387	○	○	○
		PA-78P014GC				
μPD78P014DW		PA-78P014CW				
μPD78P024CW ^{Note 3}	μPD27C1001A mode	PA-78P024CW	None	—	—	—
μPD78P024DW ^{Note 3}		PA-78P024CW				
μPD78P024GF ^{Note 3}		PA-78P024GF				
μPD78P048AGF ^{Note 3}		PA-78P048GF				
μPD78P048AKL ^{Note 3}		PA-78P048KL-S				
μPD78P054GC		PA-78P054GC	Undefined	△	△	△
μPD78P054GK		PA-78P054GK				
μPD78P054KK ^{Note 3}		PA-78P054KK-T				
μPD78P064GC		PA-78P064GC	None	—	—	—
μPD78P064GF		PA-78P064GF				
μPD78P064KL ^{Note 3}	PA-78P064KL-T					
μPD78P078GC ^{Note 3}	PA-78P078GC					
μPD78P078GF ^{Note 3}	PA-78P078GF					
μPD78P078KL ^{Note 3}	PA-78P078KL-T					
μPD78P083CU ^{Note 3}	PA-78P083CU ^{Note 3}					
μPD78P083DU ^{Note 3}	PA-78P083CU ^{Note 3}					
μPD78P083GB ^{Note 3}	PA-78P083GB ^{Note 3}					
μPD78P098AGC ^{Note 3}	PA-78P054GC					
μPD78P098AKK ^{Note 3}	PA-78P054KK-T					

Notes 1. A code necessary when using a programmer adapter made by Data I/O Japan Corp.

2. When data is written by a PROM programmer made by Data I/O Japan Corp., a programmer adapter made by the company must be used.

3. Under development

Remark The symbols mean the following.

○: recognized △: Certification under way —: not recognized

PROM programmer					
R4945	AF-9703	AF-9704	AF-9705	PKW-1100	PKW-3100
R49451A (sold separately)	Unnecessary		AF-9810 (sold separately)	RX-1 (sold separately)	ADAPTER B mk II (sold separately)
Unnecessary	Unnecessary		EPROM (Algorithm) (sold separately)	Unnecessary	
Advantest Corp	Ando Electric Co., Ltd.			AVAL DATA Corp	
—	—	—	—	—	—
○	○	○	○	○	○
—	—	—	—	—	—
○	○	○	○	○	○
—	—	—	—	—	—
—		—	—		
△		△	△		
—		—	—		
△		△	△		

Table 6-5. 78K/II Series PROM Programmer Made by Third Party

On-chip PROM product	Programming mode	Programmer adapter	PROM programmer		
		Product name	UNISITE	2900	3900
		Socket adapter	PinSite (sold separately)	Unnecessary	
		Others	Base for PinSite PPI adapter (sold separately)	Base for 2900 PPI adapter (sold separately) For library 2900 for microcomputer (sold separately)	Base for 3900 PPI adapter (sold separately) For library 3900 for microcomputer (sold separately)
		Manufacturer	Data I/O Japan Corp.		
μ PD78P214CW	μ PD27C256A mode	PA-78P214CW	○	○	○
μ PD78P214DW		PA-78P214CW			
μ PD78P214GC		PA-78P214GC			
μ PD78P214GJ		PA-78P214GJ	—	—	—
μ PD78P214GQ		PA-78P214GQ			
μ PD78P214L		PA-78P214L	○	○	○
μ PD78P224GJ		PA-78P224GJ	—	—	—
μ PD78P224L		PA-78P224L	○		○
μ PD78P238GC		PA-78P238GC	○	○	○
μ PD78P238GJ		PA-78P238GJ			
μ PD78P238KF		PA-78P238KF	—	—	—
μ PD78P238LQ		PA-78P238LQ			

Remarks 1. A programmer adapter made by NEC must be used.

2. The symbols mean the following:

○: Certified —: Not certified

Table 6-2. 78KIII Series PROM Programmer Made by Third Party

PROM programmer			
R4945	AF-9703	AF-9704	AF-9705
R49451A (sold separately)	Unnecessary		AF-9810 (sold separately)
Unnecessary	Unnecessary		EPROM Algorithm (sold separately)
Advantest Corp.	Ando Electric Co., Ltd		
—	○	○	○
○	—	—	—
—	○	○	○
○	—	—	—

Notes: 1. The conventional product "KE" can be used.
 2. Under development.
 Remarks: 1. A programmer adapter made by NEC must be used.
 2. The symbols mean the following:
 ○: Certified △: Confirmation under way —: Not carried

Table 6-6. 78K/III Series PROM Programmer Made by Third Party

On-chip PROM product	Programming mode	Programmer adapter	PROM programmer		
		Product name	UNISITE	2900	3900
		Socket adapter	PinSite (sold separately)	Unnecessary	
		Others	Base for PinSite PPI adapter (sold separately)	Base for 2900 PPI adapter (sold separately) For library 2900 for microcomputer (sold separately)	Base for 3900 PPI adapter (sold separately) For library 3900 for microcomputer (sold separately)
		Manufacturer	Data I/O Japan Corp		
μPD78P312ACW/DW		PA-78P312CW	○	○	—
μPD78P312AR/GQ		PA-78P312GQ			
μPD78P312AL		PA-78P312L			
μPD78P312AGF		PA-78P312GF			
μPD78P322L	μPD27C256A mode	PA-78P322L			
μPD78P322GJ		PA-78P322GJ			
μPD78P322GF		PA-78P322GF			
μPD78P322KC		PA-78P322KC			
μPD78P322KD		PA-78P322KD	—	—	
μPD78P322K		PA-78P322K			
μPD78P324LP	μPD27C1001A Byte mode	PA-78P324LP	○	○	△
μPD78P324GJ		PA-78P324GJ			
μPD78P324KC		PA-78P324KC			
μPD78P324KD		PA-78P324KD	○	○	—
μPD78P328CW/DW	μPD27C256A mode	PA-78P328CW			
μPD78P328GF		PA-78P328GF			
μPD78P334LQ		PA-78P334LQ	—	—	△
μPD78P334GJ		PA-78P334GJ			
μPD78P334KW ^{Note 1}		PA-78P334KW ^{Note 1}			
μPD78P334KM-S		PA-78P334KM	△	△	—
μPD78P352G		PA-78P352G ^{Note 2}	○	○	○
μPD78P352KK-S ^{Note 2}		PA-78P352KK ^{Note 2}	—	—	—
μPD78P356GC ^{Note 2}	μPD27C1001A Byte mode	PA-78P356GC ^{Note 2}			
μPD78P356GD ^{Note 2}		PA-78P356GD ^{Note 2}			
μPD78P356KP-S ^{Note 2}		PA-78P356KP ^{Note 2}			
μPD78P368GF ^{Note 2}		PA-78P368GF ^{Note 2}			
μPD78P368KL-S ^{Note 2}		PA-78P368KL ^{Note 2}			
μPD78P372GF ^{Note 2}		PA-78P372GF			
μPD78P372KL-S ^{Note 2}		PA-78P372KL			

Notes 1. The conventional product "KE" can be used.

2. Under development

Remarks 1. A programmer adapter made by NEC must be used.

2. The symbols mean the following:

○: Certified △: Certification under way —: Not certified

PROM programmer						
R4945	R4952	AF-9703	AF-9704	AF-9705	PKW-1100	PKW-3100
R49451A (sold separately)	R49512B (sold separately)	Unnecessary		AF-9810 (sold separately)	RX-1 (sold separately)	ADAPTER B mk II (sold separately)
Unnecessary		Unnecessary		EPROM Algorithm (sold separately)	Unnecessary	
Advantest Corp		Ando Electric Co., Ltd			AVAL DATA Corp	
○	—	○	○	○	○	○
—		—	—	—	—	—
○						
—						
△						
—	○				○	○
△	△				—	—
—	—		△	△		
—	—		—	—	—	—

[MEMO]

7. 78K SERIES-RELATED DOCUMENTS

Some of this information may be preliminary, but is not marked as such. Please keep this in mind as you refer to this information.

Caution This information may be changed without notice. For purposes of design, etc., be sure to refer to the latest information.

Remark Numbers in the table refer to the numbers of Japanese language documents. Numbers in brackets [] refer to the numbers of English language documents. Where a number in brackets [] does not appear, there is no associated English language document.

7.1 Documents List

Table 7-1. 78K/0 Series Documents List (1/3)

Target device	Brochure	Preliminary product information	Data sheet	User's manual	Application note	Special function register list	Instruction list	Instruction set
μ PD78001B	IF-6287 [IF-2024]	—	IC-8403 [IC-3067]	IEU-788 [IEU-1334]	IEA-715 [IEA-1288] (Fundamental I)	IEM-5547	IEM-5522	IEM-5521
μ PD78002B				IEU-849 [IEU-1372] (Instruction)	IEA-740 [IEA-1299] (Fundamental II)			
μ PD78001BY		—	IC-8571 [IC-3173]					
μ PD78002BY								
μ PD78011B	IF-6282 [IF-2023]	—	IC-8201 [IC-3179]	IEU-780 [IEU-1343]	IEA-715 [IEA-1288] (Fundamental I)	IEM-5527		
μ PD78012B				IEU-849 [IEU-1372] (Instruction)	IEA-740 [IEA-1299] (Fundamental II)			
μ PD78013								
μ PD78014								
μ PD78P014		—	IC-8111 [IC-3098]		IEA-718 [IEA-1289] (Floating-point arithmetic operation program)			
μ PD78011BY		—	IC-8573 [IC-3405]		IEA-744 [IEA-1301] (Electric notebook)*			
μ PD78012BY								
μ PD78013Y								
μ PD78014Y								
μ PD78P014Y		—	IC-8572 [IC-3180]					
μ PD78023	IF-6338 [IF-2028]	[IP-3318]	ID-8827	IEU-842 [IEU-1373]		IEM-5586		
μ PD78024				IEU-849 [IEU-1372] (Instruction)				
μ PD78P024		IP-8833 [IP-3289]	—					

*: μ PD78014, 78P014 only

Table 7-1. 78K/0 Series Documents List (2/3)

Target device	Brochure	Preliminary product information	Data sheet	User's manual	Application note	Special function register list	Instruction list	Instruction set				
μ PD78042A	IF-6257 [IF-2030]	—	IC-8834 [IC-3317]	IEU-860 [IEU-1394]	IEA-715 [IEA-1288] (Fundamental I) IEA-740 [IEA-1299] (Fundamental II) IEA-718 [IEA-1289] (Floating-point arithmetic operation program)	IEM-5588	IEM-5522	IEM-5521				
μ PD78043A				IEU-849 [IEU-1372] (Instruction)								
μ PD78044A												
μ PD78045A												
μ PD78048A		IP-8892 [IP-3408]	—									
μ PD78052	IF-6312	—	IC-8631 [IC-3403]	IEU-824 [IEU-1356]		IEM-5574						
μ PD78053				IEU-849 [IEU-1372] (Instruction)								
μ PD78054												
μ PD78P054		—	IC-8635 [IC-3216]									
μ PD78055	—	—	IC-8631 [IC-3403]	IEM-5582								
μ PD78056	IF-6312											
μ PD78058												
μ PD78P058	—	IP-8884 [IP-3363]	—									
μ PD78052Y	IF-6316 [IF-2032]	IP-8733 [IP-3253]	—								In preparation IEU-849 [IEU-1372] (Instruction)	
μ PD78053Y												
μ PD78054Y												
μ PD78P054Y		IP-8719 [IP-3205]				—						
μ PD78055Y	—	IP-8733 [IP-3253]	—									
μ PD78056Y	IF-6316											
μ PD78058Y												
μ PD78P058Y	—	IP-8892	—									
μ PD78062	IF-6313	—	IC-8632 [IC-3244]	IEU-817 [IEU-1364]					IEM-5568			
μ PD78063				IEU-849 [IEU-1372] (Instruction)								
μ PD78064												
μ PD78P064		—	IC-8636 [IC-3224]									

Table 7-1. 78K/0 Series Documents List (3/3)

Target device	Brochure	Preliminary product information	Data sheet	User's manual	Application note	Special function register list	Instruction list	Instruction set				
μ PD78074	—	IP-8924 [IP-3463]	—	IEU-874	IEA-715 [IEA-1288] (Fundamental I)	To be prepared	IEM-5522	IEM-5521				
μ PD78075				IEU-849 [IEU-1372] (Instruction)	IEA-740 [IEA-1299] (Fundamental II)							
μ PD78076	IF-6373 [IF-2040]				IEA-718 [IEA-1289] (Floating-point arithmetic operation program)							
μ PD78078												
μ PD78P078		IP-8921 [IP-3406]	—									
μ PD78081	—	IP-9027	—	IEU-886		IEM-5599						
μ PD78082				IEU-849 [IEU-1372] (Instruction)								
μ PD78P083		IP-9044	—									
μ PD78094	IF-6349	—	IC-9017	IEU-854 [IEU-1381]		IEM-5591						
μ PD78095				IEU-849 [IEU-1372] (Instruction)								
μ PD78096												
μ PD78098A	—											
μ PD78P098A												
		To be prepared	—									

Table 7-2. 78K/I Series Documents List

Target device	Brochure	Preliminary product information	Data sheet	User's manual	Application note	Special function register list	Instruction list	Instruction set
μ PD78134	IF-213	—	IC-7839 [IC-2529]	IEU-668 [IEU-1267]	IEA-654 [IEA-1241] (VCR servo)	IEM-5507	IEM-5506	IEM-5505
μ PD78134A	IF-260	—	IC-8447 [IC-3065]	IEU-740 [IEU-1324]	IEA-708 [IEA-1284] (VCR servo program)	IEM-5529	IEM-5531	IEM-5530
μ PD78136								
μ PD78138								
μ PD78P138		—	IC-8051 [IC-2960]					
μ PD78146	IF-299	—	IC-8387 [IC-2919]	IEU-764 [IEU-1319]	IEA-738 [IEA-1295] (VCR)	IEM-5541	IEM-5535	IEM-5536
μ PD78148								
μ PD78P148								
		—	IC-8195 [IC-2766]					

Table 7-3. 78K/II Series Documents List

Target device	Brochure	Preliminary product information	Data sheet	User's manual	Application note	Special function register list	Instruction list	Instruction set
μ PD78212	IB-5036	—	IC-7649 [IC-2526]	IEM-5119 [IEU-1236] (Hardware) IEU-754 [IEU-1311] (Instruction)	IEA-607 [IEA-1220] (Fundamental) IEA-700 [IEA-1282] (Application) IEA-686 [IEA-1273] (Floating-point arithmetic operation program)	IEM-5100	IEM-5101	IEM-5102
μ PD78213								
μ PD78214								
μ PD78P214								
μ PD78212(A)	—	—	IC-8234 [IC-2831]			—	—	—
μ PD78213(A)								
μ PD78214(A)								
μ PD78P214(A)								
μ PD78217A	IF-288	—	IC-8131 [IC-2748]	IEU-755 [IEU-1313] (Hardware) IEU-754 [IEU-1311] (Instruction)		IEM-5532	IEM-5101	IEM-5102
μ PD78218A								
μ PD78P218A								
μ PD78218A(A)								
μ PD78220	IB-5011	—	IC-5457 [IC-2374]	IEM-5019 [IEU-1215] (Hardware) IEU-754 [IEU-1311] (Instruction)		IEM-999	IEM-5101	IEM-5102
μ PD78224								
μ PD78P224								
μ PD78233	IF-207	—	IC-7902 [IC-2476]	IEU-718 [IEU-1290] (Hardware) IEU-754 [IEU-1311] (Instruction)		IEM-5515		
μ PD78234								
μ PD78237								
μ PD78238								
μ PD78P238								
μ PD78234(A)								
μ PD78238(A)								
μ PD78243	IF-6339	—	IC-8070 [IC-2774]	IEU-747 [IEU-1316] (Hardware) IEU-754 [IEU-1311] (Instruction)		IEM-5528	IEM-5101	IEM-5102
μ PD78244								

Table 7-4. 78K/III Series Documents List (1/2)

Target device	Brochure	Preliminary product information	Data sheet	User's manual	Application note	Special function register list	Instruction list	Instruction set
μ PD78310A	—	—	IC-7920 [IC-2511]	IEM-5086 [IEU-1265]	IEM-964 [IEM-1133] (Fundamental) IEA-628 [IEA-1243] (Floating-point arithmetic operation program)	IEM-5118	IEM-5115	IEM-5116
μ PD78312A		—	IC-7772 [IC-2512]					
μ PD78P312A		—	IC-8272 [IC-2837]					
μ PD78310A(A)		—	IC-8272 [IC-2837]					
μ PD78312A(A)		—	IC-8272 [IC-2837]					
μ PD78320	IF-6293	—	IC-7637 [IC-2354]	IEU-619 [IEU-1248]	IEA-684 [IEA-1272] (Software-Fundamental) IEA-719 [IEA-1291] (Floating-point arithmetic operation program)	IEM-5501	IEM-602	IEM-601
μ PD78322		—	IC-7934 [IC-2485]					
μ PD78P322		—	IC-8314 [IC-2870]					
μ PD78323		—	IC-8314 [IC-2870]					
μ PD78324		—	IC-8315					
μ PD78P324		[IP-2857]	IC-8315					
μ PD78320(A), (A1), (A2)	IF-6318	—	IC-8327 [IC-2879]			—	—	—
μ PD78322(A), (A1), (A2)		—	IC-8712 [IC-3211]					
μ PD78323(A), (A1), (A2)		—	IC-8712 [IC-3211]					
μ PD78324(A), (A1), (A2)		—	IC-8315					
μ PD78P324(A), (A1), (A2)		—	IC-8315					
μ PD78327	IF-227	—	IC-7896 [IC-2521]	IEU-693 [IEU-1268]	IEA-716 [IEA-1287] (Hardware-Fundamental) IEA-684 [IEA-1272] (Software-Fundamental) IEA-719 [IEA-1291] (Floating-point arithmetic operation program)	IEM-5514	IEM-602	IEM-601
μ PD78328		—	IC-7911 [IC-2486]					
μ PD78P328		—	IC-7911 [IC-2486]					
μ PD78327(A)	—	—	IC-8291 [IC-2858]			—	—	—
μ PD78328(A)		—	IC-8291 [IC-2858]					
μ PD78330	IF-6340	—	IC-7927 [IC-2552]	IEU-729 [IEU-1315]	IEA-684 [IEA-1272] (Software-Fundamental) IEA-719 [IEA-1291] (Floating-point arithmetic operation program)	IEM-5518	IEM-602	IEM-601
μ PD78334		—	IC-8075 [IC-2648]					
μ PD78P334		—	IC-8075 [IC-2648]					
μ PD78330(A), (A1), (A2)	IF-6292 [IF-2027]	—	IC-8494 [IC-3364]			—	—	—
μ PD78334(A), (A1), (A2)		—	IC-8494 [IC-3364]					
μ PD78P334(A), (A1), (A2)		—	IC-8804 [IC-3264]					

Table 7-4. 78K/III Series Documents List (2/2)

Target device	Brochure	Preliminary product information	Data sheet	User's manual	Application note	Special function register list	Instruction list	Instruction set
μ PD78350	IF-6335 IIF-20361	—	IC-8279 [IC-2845]	IEU-781 [IEU-1327] (Hardware)	IEA-684 [IEA-1272] (Software-Fundamental) IEA-719 [IEA-1291] (Floating-point arithmetic operation program)	IEM-5540 [IEM-1215]	—	IEM-5543
μ PD78350A		—	IC-8823 [IC-3391]	IEU-853 (Instruction)				
μ PD78352A								
μ PD78P352		—	IC-8423 [IC-2957]					
μ PD78355	IF-6298	IP-8601 [IP-3145]	—	IEU-828 [IEU-1361] (Hardware)		IEM-5576 [IEM-1214]		
μ PD78356				IEU-853 (Instruction)				
μ PD78P356		IP-8609 [IP-3146]	—					
μ PD78365	IF-6319	IP-8701 [IP-3273]	—	IEU-836 [IEU-1365] (Hardware)		IEM-5577		
μ PD78366				IEU-853 (Instruction)				
μ PD78P368		IP-8682 [IP-3150]	—					
μ PD78370	IF-6351	IP-8787 [IP-3314]	—	IEU-840 [IEU-1368] (Hardware)	IEM-5585			
μ PD78372				IEU-853 (Instruction)				
μ PD78P372		IP-8788 [IP-3251]	—					

Table 7-5. 78K/IV Series Documents List

Target device	Brochure	Preliminary product information	Data sheet	User's manual	Application note	Special function register list	Instruction list	Instruction set
μ PD784020	To be prepared	To be prepared	—	In preparation	—	IEM-5579	IEM-5580	IEM-5572
μ PD784021	IF-6311	IP-8776 [IP-3234]	—	IEU-850 [IEU-1379] (Hardware) IEU-844 (Instruction)				
μ PD784025		IP-8722 [IP-3230]	—					
μ PD784026								
μ PD78P4026		IP-8734 [IP-3231]	—					

7.2 Tool Documents List

[01M3W]

Table 7-6. 78K/0 Series Tool Documents List

Target product			User's manual			
Device (representative product)	In-circuit emulator name	I/O emulation board name	In-circuit emulator	I/O emulation board	Screen debugger (SD)	
					MS-DOS	PC DOS
μ PD78002B μ PD78002BY	IE-78000-R	IE-78014-R-EM	EEU-810 [EEU-1398]	EEU-805 [EEU-1400]	EEU-852 [EEU-1414] (Beginner's guide)	EEU-956 [EEU-1447] (Reference)
μ PD78014 μ PD78014Y						
μ PD78024		IE-78044-R-EM		EEU-833 [EEU-1424]		
μ PD78044A						
μ PD78054 μ PD78054Y		IE-78064-R-EM		EEU-905 [EEU-1443]		
μ PD78064						
μ PD78078 μ PD78082		IE-78078-R-EM		EEU-978 [EEU-1504]		
μ PD78098A						
		IE-78098-R-EM		EEU-933 [EEU-1473]		

Table 7-7. 78K/I Series Tool Documents List

Target product		User's manual	
Device (representative product)	In-circuit emulator name	In-circuit emulator	Relocatable assembler (RA)
μ PD78138	IE-78130-R	EEU-647 (Hardware)	EEU-883 (Operation)
		EEU-648 [EEU-1263] (Software)	
μ PD78148	IE-78140-R	EEU-771 (Hardware)	EEU-901 (Structured assembler)
		EEU-767 [EEU-1385] (Software)	

User's manual			
Relocatable assembler (RA)	C Compiler (CC)	Real-time OS (RX)	Fuzzy inference development support system
EEU-809 [EEU-1399] (Operation)	EEU-656 [EEU-1280] (Operation)	EEU-912 (Fundamental)	EEU-829 [EEU-1438] (Fuzzy knowledge data creation tool)
EEU-815 [EEU-1404] (Language)	EEU-655 [EEU-1284] (Language)	EEU-911 (Installation)	EEU-862 [EEU-1444] (Translator)
EEU-817 [EEU-1402] (Structured assembler)	EEU-777 (Library source file)	EEU-930 (Debugger)	EEU-858 (Fuzzy inference module)
		EEU-913 (Technical)	EEU-921 (Fuzzy inference debugger)

Table 7-8. 78K/II Series Tool Documents List (1/2)

Target product		User's manual				
Device (representative product)	In-circuit emulator name	In-circuit emulator		Screen debugger (SD)		Evaluation board (EB)
		MS-DOS	PC DOS	MS-DOS	PC DOS	
μPD78214	IE-78210-R	EEP-640 [EEP-1027] (Hardware)		—	—	EEU-676 [EEU-1293]
		EEM-685 [EEM-1024] (Software)				
		EEM-677 [EEM-1260] (Software)	EEM-753 [EEM-1027] (Software)			
	IE-78240-R	EEU-705 [EEU-1322] (Hardware)				
		EEU-706 [EEU-1331] (Software)				
	IE-78240-R-A	EEU-796 [EEU-1395]		EEU-841 (Beginner's guide)	EEU-956 [EEU-1447] (Reference)	
				EEU-813 (Reference)		
μPD78218A μPD78244	IE-78240-R	EEU-705 [EEU-1322] (Hardware)		—	—	EEU-765 [EEU-1452]
		EEU-706 [EEU-1331] (Software)				
	IE-78240-R-A	EEU-796 [EEU-1395]		EEU-841 (Beginner's guide)	EEU-956 [EEU-1447] (Reference)	
				EEU-813 (Reference)		

User's manual			
Relocatable assembler (RA)	C Compiler (CC)	Real-time OS (RX)	Fuzzy inference development support system
EEU-809 [EEU-1399] (Operation)	EEU-656 [EEU-1280] (Operation)	EEU-900 (Fundamental)	EEU-829 [EEU-1438] (Fuzzy knowledge data creation tool)
EEU-815 [EEU-1404] (Language)	EEU-655 [EEU-1284] (Language)	EEU-884 (Installation)	EEU-862 [EEU-1444] (Translator)
EEU-817 [EEU-1402] (Structured assembler)	EEU-777 (Library source file)	EEU-895 (Debugger)	EEU-860 [EEU-1440] (Fuzzy inference module)
		EEU-885 (Technical)	EEU-917 [EEU-1459] (Fuzzy inference debugger)

Table 7-8. 78K/II Series Tool Documents List (2/2)

Target product		User's manual				
Device (representative product)	In-circuit emulator name	In-circuit emulator		Screen debugger (SD)		Evaluation board (EB)
		MS-DOS	PC DOS	MS-DOS	PC DOS	
μ PD78224	IE-78220-R	EEP-642 [EEP-1028] (Hardware) EEM-687 [EEM-1025] (Software) EEM-678 [EEM-1261] (Software)	EEM-755 [EEM-1029] (Software)	—	—	EEU-677 [EEU-1292]
	IE-78230-R	EEU-682 [EEU-1327] (Hardware) EEU-685 [EEU-1296] (Software)		—	—	
	IE-78230-R-A	EEU-789 [EEU-1392]		EEU-841 (Beginner's guide) EEU-813 (Reference)	EEU-956 [EEU-1447] (Reference)	
μ PD78234	IE-78230-R	EEU-682 [EEU-1327] (Hardware) EEU-685 [EEU-1296] (Software)		—	—	EEU-678 [EEU-1300]
	IE-78230-R-A	EEU-789 [EEU-1392]		EEU-841 (Beginner's guide) EEU-813 (Reference)	EEU-956 [EEU-1447] (Reference)	

User's manual			
Relocatable assembler (RA)	C Compiler (CC)	Real-time OS (RX)	Fuzzy inference development support system
EEU-809 [EEU-1399] (Operation)	EEU-656 [EEU-1280] (Operation)	EEU-900 (Fundamental)	EEU-829 [EEU-1438] (Fuzzy knowledge data creation tool)
EEU-815 [EEU-1404] (Language)	EEU-655 [EEU-1284] (Language)	EEU-884 (Installation)	EEU-862 [EEU-1444] (Translator)
EEU-817 [EEU-1402] (Structured assembler)	EEU-777 (Library source file)	EEU-895 (Debugger)	EEU-860 [EEU-1440] (Fuzzy inference module)
		EEU-885 (Technical)	EEU-917 [EEU-1459] (Fuzzy inference debugger)

User's manual			
Relocatable assembler (RA)	C Compiler (CC)	Real-time OS (RX)	Fuzzy inference development support system
EEU-809 [EEU-1399] (Operation)	EEU-656 [EEU-1280] (Operation)	EEU-900 (Fundamental)	EEU-829 [EEU-1438] (Fuzzy knowledge data creation tool)
EEU-815 [EEU-1404] (Language)	EEU-655 [EEU-1284] (Language)	EEU-884 (Installation)	EEU-862 [EEU-1444] (Translator)
EEU-817 [EEU-1402] (Structured assembler)	EEU-777 (Library source file)	EEU-895 (Debugger)	EEU-860 [EEU-1440] (Fuzzy inference module)
		EEU-885 (Technical)	EEU-917 [EEU-1459] (Fuzzy inference debugger)

Table 7-9. 78K/III Series Tool Documents List

Target product			User's manual		
Device (representative product)	In-circuit emulator name	I/O emulation board name	In-circuit emulator	I/O emulation board	Evaluation board (EB)
μ PD78312A	IE-78310A-R	—	EEU-645 [EEU-1247] (Hardware)	—	—
			EEU-637 [EEU-1248] (Software)		
μ PD78322	IE-78327-R		EEU-718 [EEU-1358] (Hardware)		EEU-653 [EEU-1264]
μ PD78328			EEU-720 [EEU-1341] (Software)		EEU-681 [EEU-1342]
μ PD78334	IE-78330-R		EEU-713 [EEU-1326] (Hardware)		EEU-687 [EEU-1312]
			EEU-714 [EEU-1298] (Software)		
μ PD78352A	IE-78350-R	IE-78350-R-EM1	EEU-754 [EEU-1366] (Hardware)	EEU-773 [EEU-1377]	EEU-772 [EEU-1386]
μ PD78356		IE-78355-R-EM1		EEU-866 [EEU-1423]	—
μ PD78366		IE-78365-R-EM1		EEU-924 [EEU-1454]	
μ PD78372		IE-78370-R-EM1		EEU-946 [In preparation]	

Table 7-10. 78K/IV Series Tool Documents List

Target product				User's manual		
Device (representative product)	In-circuit emulator name	Emulation board name	I/O emulation board name	In-circuit emulator	Emulation board	I/O emulation board
μ PD784026	IE-784000-R	IE-784000-R-EM	IE-784026-R-EM1	To be prepared	To be prepared	To be prepared

User's manual			
Relocatable assembler (RA)	C Compiler (CC)	Real-time OS (RX)	Fuzzy inference development support system
EEM-715 [EEM-1399] (Operation)	EEU-656 [EEU-1280] (Operation)	EEU-824 [EEU-1419] (Fundamental)	EEU-829 (Fuzzy knowledge data creation tool)
EEM-693 [EEM-1404] (Language)	EEU-655 [EEU-1284] (Language)	EEU-823 [EEU-1420] (Installation)	EEU-909 (Translator)
EEU-817 [EEU-1402] (Structured assembler)	EEU-777 (Library source file)	EEU-830 (Debugger)	EEU-910 (Fuzzy inference module)
EEU-752 [EEU-1362] (ECC generator)		EEU-855 (Technical)	EEU-920 (Fuzzy inference debugger)

User's manual				
Integrated debugger (ID)		Relocatable assembler (RA)	C compiler (CC)	Real-time OS (RX)
MS-DOS	PC DOS			
To be prepared (Beginner's guide)	To be prepared (Beginner's guide)	To be prepared (Operation)	To be prepared (Operation)	To be prepared (Fundamental)
To be prepared (Reference)	To be prepared (Reference)	To be prepared (Language)	To be prepared (Language)	To be prepared (Installation)
		To be prepared (Structured assembler)	To be prepared (Library source file)	To be prepared (Debugger)
				To be prepared (Technical)

[MEMO]

List's items			
Production equipment (PVE)	C Compiler (CC)	Real-time OS (RTO)	Language (L)
EEU-175 (EEU-175) (Operation)	EEU-655 (EEU-175) (Operation)	EEU-824 (EEU-141) (Fundamental)	EEU-825 (EEU-141) (Fundamental)
EEU-655 (EEU-175) (Operation)	EEU-655 (EEU-175) (Operation)	EEU-825 (EEU-141) (Fundamental)	EEU-825 (EEU-141) (Fundamental)
EEU-817 (EEU-175) (Structure assembly)	EEU-717 (Library source file)	EEU-825 (EEU-141) (Fundamental)	EEU-817 (EEU-141) (Library source file)
EEU-725 (EEU-175) (EC Generation)		EEU-825 (EEU-141) (Fundamental)	EEU-725 (EEU-141) (EC Generation)

List's items				
MS-DOS	Integrated developer (ID)		Real-time OS (RTO)	Language (L)
	PC DOS	Real-time OS (RTO)		
To be prepared (to be prepared)	To be prepared (to be prepared)	To be prepared (to be prepared)	To be prepared (to be prepared)	To be prepared (to be prepared)
To be prepared (to be prepared)	To be prepared (to be prepared)	To be prepared (to be prepared)	To be prepared (to be prepared)	To be prepared (to be prepared)
To be prepared (to be prepared)	To be prepared (to be prepared)	To be prepared (to be prepared)	To be prepared (to be prepared)	To be prepared (to be prepared)
To be prepared (to be prepared)	To be prepared (to be prepared)	To be prepared (to be prepared)	To be prepared (to be prepared)	To be prepared (to be prepared)